This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

MEADE'S

ANUAL FOR STUDENTS

PREPARING

FOR

Examination at Apothecaries' Hall

OR

OTHER MEDICAL INSTITUTIONS.

THIRD EDITION.

MUCH IMPROVED, AND CORRECTED TO THE PRESENT TIME.

LONDON:
HENRY RENSHAW, 356, STRAND.
1859.

167. c. 180

LONDON:
SAVILL AND EDWARDS, PRINTERS, CHANDOS-STREET,
COVENT-GARDEN.

PREFACE TO SECOND EDITION.

THE present work, of which the first edition was published in 1839, has since that time maintained a high character, as an accurate and compendious view of the different branches of medical education. In as short a space as possible, it gives a clear epitome of Chemistry, Pharmacy, Materia Medica, Toxicology, Visceral Anatomy, Practice of Medicine, and the leading principles of Midwifery, regard being had to the most practical parts of each subject.

In the present edition, many of the less important topics have been abridged, and thus (especially with the help of smaller type) room has been made for the introduction of the doctrines of Liebig, which, it is hoped, are treated of in an easy and interesting manner; and for those other improvements in the medical art which have been made within the last seven years. The principles of Midwifery are also added to this edition.

PREFACE TO THIRD EDITION.

ANUALS are useful, especially to the advanced tudent, as they direct his attention to the more ssential portions of his studies, and thus contribute) that classification and condensation of his know- dge so necessary to his examination, and, indeed,) his success in after-life.

The utility of this Manual has been proved by s success. A new edition is now required, and the pportunity has been taken to make considerable nprovements in it, so as to meet the present ad- anced state of medical science, and its consequently ıcreased requirements; amongst them is an addi- .onal subject, namely, Botany.

The Court of Examiners of the Apothecaries' lall having divided their examinations into two eries of subjects, the arrangement in this Edition ccords with this alteration; so that the student will e enabled to study the subjects as appointed by the Court for his First and Second Examinations.

It is the confident *hope of the* Editor that the present *improved edition of* MEADE'S MANUAL

will be of material aid to the student in prep
for his examinations, and will thus secure t
still more flattering success than that which
attended the previous editions.

LONDON, *July*, 1859.

CONTENTS.

FIRST EXAMINATION.

PART I.—ANATOMY AND PHYSIOLOGY.

	PAGE
Bones of the Cranium	1
Nervous System	6
Organs of Sense	35
The Skin	35
The Tongue	37
The Nose	42
The Eye	42
The Ear	49
Anatomy of the Viscera	52
The Chest	52
The Lungs	58
The Heart	61
The Arteries	65
The Veins	72
The Lymphatics	77
Cavity of the Abdomen	81
Chylopoietic Viscera	85
Arteries of the Viscera	90
The Liver	92
Physiology of Digestion	97
Genito-Urinary Organs	99
Female Organs of Generation	105
Anatomy of the Fœtus	109
Relative Anatomy	111

PART II.—CHEMISTRY.

Matter, *Attraction, Affinity,* Atomic Theory, &c. . 115
Light 120

PAGE
Heat 125
Electricity 134
Galvanism 137
Non-metallic Elementary Bodies 139
Metals 157
Acids, Bases, and Salts 163
Organic Chemistry 167
Vegetable Chemistry 169
Animal Chemistry 177
Liebig's Theories on Organic Chemistry 179
Respiration and Animal Heat 182
Digestion 184
The Blood 184
The Bile 185
The Urine 186
Chemistry of the Secretions 192
Fermentation 195

PART III.—PHARMACEUTICAL DECOMPOSITIONS.

Acids 197
Æthers 219
Alkalis 224
Vegetable Preparations 231
Animal Preparations 235
Metallic Preparations 235

PART IV.—MATERIA MEDICA.

(*Arranged alphabetically*) 292

PART V.—BOTANY.

Classification of Medicinal Plants 414
Sensible qualities of Plants 419
Structure of Plants 419
Nutrition of Plants 422
Respiration of Plants 422

SECOND EXAMINATION.

PART VI.—PRACTICE OF MEDICINE AND PATHOLOGY.

PAGE

Fevers 423
Intermittent Fevers 424
Remittent Fevers 426
Infantile Remittent 428
Hectic Fever 430
Continued Fevers 431
Synocha, Synochus, Typhus 432
Morbid Appearances 435
Miliary Fever 438
Measles 439
Scarlatina 440
Erysipelas 443
Chicken Pox 444
Small Pox 444
Vaccination 448
Rheumatism 448
Gout 450
Diseases of the Nervous System 453
Acute Hydrocephalus 453
Morbid Appearances 455
Encephalitis 456
Morbid Appearances 457
Delirium Tremens 459
Apoplexy 460
Morbid Appearances 463
Paralysis 465
Epilepsy 467
Morbid Appearances 469
Chorea 470
Hysteria 472
Catalepsy 474
Diseases of the Respiratory Organs 475
Laryngitis 475
Croup 477
Morbid Appearances 479

PAGE

Spasm of the Glottis 480
Table of Auscultation, &c. 481
Bronchitis 487
Morbid Appearances 491
Whooping Cough 494
Morbid Appearances 495
Chronic Bronchitis 496
Bronchial Polypi 497
Influenza 497
Spasmodic Asthma 497
Morbid Appearances 499
Pneumonia 500
Morbid Appearances 506
Pulmonary Emphysema 508
Morbid Appearances 508
Interlobular Emphysema 509
Œdema of the Lungs 509
Morbid Appearances 510
Phthisis Pulmonalis 511
Morbid Appearances 512
Pleuritis 525
Morbid Appearances 528
Diseases of the Heart 531
Auscultation of the Heart 531
Inflammation of the Heart 534
Morbid Appearances 535
Hypertrophy and Atrophy of the Heart . . . 536
Angina Pectoris 539
Hæmorrhage 540
Epistaxis 540
Hæmoptysis and Pulmonary Apoplexy . . . 542
Hæmatemesis 544
Hæmaturia 545
Scurvy and Purpura 547
Dropsies 548
Ovarian Dropsy 549
Diseases of the Digestive Organs 551
Pseudo Membranous Inflammation 551
Aphthæ 551
Cynanche Tonsillaris 552
Diphtheria 552

PAGE
Inflammation of the Pharynx 552
Gastritis 553
Dyspepsia 554
Dysentery 555
Morbid Appearances 555
Diarrhœa 556
Cholera 557
Asiatic Cholera 558
Colic 559
Colica Pictonum 560
Ileus 560
Peritonitis 561
Enteritis 561
Tabes Mesenterica 561
Worms 562
Hepatitis 563
Chronic Disease of Liver 563
Jaundice 564
Gall Stones 565
Splenitis 566
Diseases of the Urinary Organs 567
Nephritis 567
Desquamative Nephritis 568
Bright's Disease 569
Diabetes 569
Cystitis 569
Asphyxia 570

PART VII.—PRINCIPLES OF MIDWIFERY.

Menstruation and its Disorders 571
Signs of Pregnancy 576
Disorders of Pregnancy 580
Abortion and Premature Labour 581
Duration of Pregnancy 583
Natural Labour and its Treatment 583
Spurious Pains 586
Different Kinds of Presentation 586
Presentations of the Head 587
On Lingering Labour 589

PAGE
Presentation of Breech 5
,, ,, Inferior Extremities 5
,, ,, Superior Extremities 5
Twin Cases, Triplets, &c. 5
Flooding 5
Puerperal Convulsions 6
,, Mania 6
,, Fever 6
,, Pathology 6

PART VIII.—FORENSIC MEDICINE AND TOXICOLOGY.

Irritant Poisons 6
Narcotic Poisons 6
Narcotico-Acrids 6
Tests for Poisons 6

PART I.

ANATOMY AND PHYSIOLOGY.

ALTHOUGH a knowledge of anatomy is as necessary to the practitioner of medicine as it is to the surgeon, yet there are several parts of the human body which the former should make himself particularly acquainted with. These are, the different viscera, the organs of sense, and the cerebro-spinal, or central-nervous system, together with the course and distribution of the cerebral nerves. It is also highly necessary that the person who undertakes the treatment of what are called *internal diseases*, should be well acquainted with the relations and sympathy which exist between the different viscera and their various parts on the one hand, and the external surface of the body on the other, in the living subject. Such knowledge, though essential for the successful explanation of disease, has as yet been much neglected by authors, who chiefly dwell on the relations and structure of viscera in the dead body; it is therefore hoped that the endeavours which have been made in the following pages to throw some light upon a few points connected with the species of knowledge alluded to will be found at once novel and useful.

BONES OF THE CRANIUM.

The head is a spheroid, placed at the upper extremity of the trunk, and is composed of the cranium and face. The anterior region of the cranium is named

the forehead, or *sinciput;* the posterior region, the *occiput.* The lateral regions comprehend the *temples;* the superior is termed the *bregma,* and the inferior region the *base.*

The cranium is composed of eight bones—four single, and two in pairs. The four single bones are, the *occipital, frontal, sphenoid,* and *ethmoid;* the two in pairs are, the *temporal* and *parietal.* The single bones are all placed on the median line; those in pairs are situate on the sides. Some authors divide the bones of the cranium into the *proper,* and those which are *common* to it and the face. In addition to the bones just mentioned are sometimes found one or more small bones (*ossa Wormiana*) in the neighbourhood of the sutures; they are rudimental structures. The surfaces along which the cranial bones unite are called sutures; these are, the coronal, sagittal, lambdoidal, and two squamous; and two prolongations denominated additamenta suturæ squamosæ et lambdoidalis.

The cranium contains the brain, with its appendages, and the pituitary body. These are enveloped in *three* membranes, which are the *dura mater,* the *arachnoid,* and the *pia mater;* or, the fibrous, serous, and cellular membranes.

The *dura mater* is a dense *fibrous* sac, which serves as an internal periosteum to the cranium, and encloses the brain, which it supports by prolongations, or processes, called the *falx* major and minor, and the *tentorium.* It adheres strongly to the base of the cranium and to the sutures; and when first exposed by removal of the skull-cap, its outer surface, on either side, is seen strongly marked by the trunk and branches of the middle meningeal artery. The dura mater is prolonged into the vertebral canal, into the orbits, and along the principal vessels and nerves which pass out through the base of the skull; and, moreover, *gives off three* processes, which may be here described:—

falx cerebri is a perpendicular prolongation of
ra mater, situate in the mesian line, of a scythe-
rm, and extending from the crista galli to the
ium. It separates the two hemispheres of the
and is supposed to serve the purpose of pre-
g too great pressure of one hemisphere upon the
Along its upper edge we have the *superior lon-
nal* sinus; its lower or concave edge contains
ferior longitudinal sinus.

tentorium is a horizontal septum, which sepa-
the posterior lobes of the cerebrum from the
surface of the cerebellum. The tentorium is
ed to the margin of the petrous portion of the
ral bones, to the transverse ridge of the occipital
and to the clinoid process of the sphenoid.
uperior petrosal and lateral sinuses run along
rder, and the straight sinus along its middle

falx cerebelli is a scythe-shaped process of the
mater, which descends perpendicularly from the
al occipital protuberance to the edge of the fora-
nagnum, and partially separates the hemispheres
cerebellum. It contains the occipital sinuses.

sinuses of the dura mater are sixteen in num-
Their walls are formed by the dura mater, and
are lined internally by a serous membrane, simi-
that of veins. They are, the *two longitudinal*,
traight sinus, the *torcular Herophili*, the *two
l*, *two occipital*, the *circular*, *two cavernous*, the
verse, and *four petrosal* sinuses.

superior longitudinal sinus extends along the
e line of the roof of the cranium, from the cristo-
of the ethmoid bone to the middle of the occipital
where it terminates in the torcular Herophili.
erebral veins open into this sinus from behind,
rds; and it sometimes also receives one or two
from the *nose through the foramen* cæcum. It
ned by several whitish bands, called *chordæ*

Willisii,* and contains some of the granular bodies denominated *glandulæ Pacchioni*.

The *inferior longitudinal* sinus occupies the free edge of the falx cerebri, and terminates in the straight sinus.

The *torcular Herophili* is an irregular cavity, situate at the union of the three great processes of the dura mater. It communicates, by *six* openings, with the superior longitudinal, the two occipital, the two lateral, and the straight sinus.

The *straight* sinus runs along the arch of the tentorium, from the end of the inferior longitudinal sinus to the torcular Herophili; it receives the veins of Galen and the superior veins of the cerebellum.

The *occipital* sinuses (*right* and *left*) commence on the sides of the foramen magnum in the falx cerebelli, and empty themselves into the torcular Herophili.

The two *lateral* sinuses carry the blood from the torcular Herophili to the jugular veins. They curve round the occipital bone, and descend into the foramen lacerum posterius, grooving in their course the occipital, posterior inferior angle of the parietal, mastoid portion of temporal, and jugular process of occipital bones.

The *cavernous* sinuses commence beneath the anterior clinoid processes, and pass backwards on each side of the sella Turcica to join the superior and inferior petrosal sinuses. The ophthalmic veins open into these sinuses. The outer wall of the cavernous sinus contains the third and fourth nerves, and the ophthalmic branch of the fifth. In the inner wall are contained the carotid artery and sixth nerve. These latter, however, are separated from the blood of the sinus by its lining membrane.

The two *inferior petrosal* sinuses descend from the

* *These bands* prevent over-distention of the sinus, and keep *the mouths of the* veins open.

cavernous sinuses to the lateral sinuses, close to the termination of which they empty themselves.

The two *superior petrosal* sinuses run along the border of the tentorium, which is attached to the upper edge of the petrous portion of the temporal bone, and join the cavernous to the lateral sinuses.

The *circular* sinus, as its name denotes, surrounds the sella Turcica and pituitary body, and communicates on either side with the cavernous sinuses.

The *transverse* sinus runs across the basilar process of the occipital bone to join one inferior petrosal sinus to the other. There are occasionally two or three transverse sinuses. The internal jugular vein conveys the blood of the sinuses to the heart.

The arteries of the dura mater are, the *anterior meningeal*, from the internal carotid, anterior and posterior ethmoidal, and lachrymal; the *posterior* meningeal, from the vertebral, occipital, and pharyngeal; the *middle* and *small* meningeals, from the internal maxillary. The nerves of the dura mater come from the sympathetic and fifth.

The *arachnoid* is placed between the dura mater and pia mater. It is a *serous* membrane, forming a shut sac, which lines the inner surface of the dura mater, and the external surface of the brain. It is also reflected back from the several nerves and vessels which pass to and from the brain; it descends into the vertebral canal along the spinal marrow, then terminates in a long canal which passes down to the extremity of the cavity of the sacrum, and there is reflected upon the dura mater. This membrane can be easily separated from the pia mater, behind the commissure of the optic nerves, near the fissure of Sylvius, and when it passes from the cerebellum to the medulla oblongata. It is said not to enter the ventricles.

The *pia mater* is a *cellular web, containing* a large quantity of *blood-vessels, which surrounds* the brain *and spinal marrow on all sides, dips* down between the

convolutions of the former, and enters the ventricles. The inner surface of the pia mater is in contact with the cerebral substance; its outer surface is in close contact with the arachnoid membrane. The pia mater, having invested the external surface of the brain, will be found to descend along the great longitudinal fissure, to pass over the corpus callosum, and enter through the fissure of Bichat into the lateral ventricles, where it forms the *tela choroidea* and choroid plexus, and then, descending through the fissure between the middle lobe and pons Varolii, to become continuous with the membrane lining the base of the brain.

NERVOUS SYSTEM.

This system may be distinguished into the *cerebro-spinal* or *voluntary*, the *sympathetic* or *involuntary* systems; with the *superadded* or *respiratory* system of Bell. The former, again, may be divided into *cerebrum*, *cerebellum*, and *spinal cord* (including in this latter the *medulla oblongata*). With respect to its composition, the nervous matter is distinguished into two substances—the *cineritious* or *cortical*, and the *medullary*. Both substances are chiefly composed of a peculiar fatty substance containing phosphorus. The white matter is seen under the microscope to consist of tubes; the grey, of minute vesicles of various shapes, containing more or less pigment. The exact connexion between the two is unknown. (*Vide* Todd and Bowman's Physiology.)

The cineritious substance (which is of various shades of grey and black) is situated externally on the cerebral hemispheres, but in the spinal marrow it is altogether deep-seated; on the contrary, the medullary matter lies superficially on the spinal marrow, pons and crura of the brain, where it is readily distinguished (if the membranes be stripped off) by its *shining white colour*. The office of the grey matter

is supposed to be that of originating and receiving sensation, volition, and the other mental powers; the office of the white matter, to be that of communicating between different parts of the grey.

THE CEREBRUM constitutes the largest portion of the cerebro-spinal system. It is divided into two large lateral masses, called *hemispheres;* each of which is subdivided into three portions, denominated *lobes.* On the superior surface the student will remark the *great longitudinal fissure* into which the falx major dips; the *convolutions,* and the *sulci,* or spaces between the convolutions. On detaching the falx, and separating the hemispheres, the *corpus callosum* is exposed; and if the hemispheres be cut away horizontally, and on a level with this latter body, the *centrum ovale* is brought into view. The *corpus callosum* is a broad transverse commissure of medullary matter, by which the lateral hemispheres are united. Its upper surface is marked by a longitudinal line, called the *raphe,* and along it run the arteries of the corpus callosum. The inferior surface of the corpus callosum forms a roof for the lateral ventricles, while in the median line it lies immediately above the septum lucidum, fifth ventricle, and fornix. On dividing the corpus callosum, the *lateral ventricles* are exposed, one on each side; the parts contained in each of these ventricles (reckoning from before backwards) are—(1) the anterior horn; (2) the corpus striatum; (3) the thalamus nervi optici; (4) the posterior horn, or digital cavity; (5) the hippocampus minor; (6) the inferior horn; (7) the hippocampus major; in addition to these parts are also found in each lateral ventricle, (8) the ænia semicircularis; (9) the choroid plexus; (10) the orpus fimbriatum.

The inferior surface of the corpus callosum, as was id, is continuous with the septum lucidum, which is rmed of two thin layers of medullary matter, conining between them the fifth ventricle; beneath the

septum lies the fornix; and if this latter body be divided in the centre, and reflected backwards and forwards, the whole of the lateral ventricles, to the description of which we now return, will be completely exposed. The first part seen is the layer of pia mater called choroid plexus and *tela choroidea;* this has been already noticed.

The anterior horn of the lateral ventricle is a cavity in the anterior lobe of the cerebrum, which runs, curvingly, forward and outwards.

The *corpus striatum* is a pyriform body, broad before, contracted behind, placed obliquely, composed externally of grey substance, somewhat tinged with brown, but internally marked by an admixture of medullary lines (striæ), from which the name is derived. It is united to its fellow by the anterior commissure.

The *thalamus opticus* is a large mass lying behind the corpus striatum, and in apposition with the analogous body of the opposite hemisphere; the soft substance uniting the thalami is called the *commissura mollis*, and they contain between them the third ventricle. On the posterior border of each thalamus are observed two slightly raised eminences (*corpus geniculatum internum et externum*), which are connected by medullary striæ to the tubercula quadrigemina, and to the origin of the optic nerves.

The posterior horns of the lateral ventricles, instead of diverging, like the anterior ones, converge, and present when laid open the hippocampus minor, which is a small elevation of medullary matter.

The middle inferior horns pass backwards and outwards, but then wind forwards and inwards to terminate close to the fissure of Sylvius. In this horn we find the *hippocampus major*, a large elevation of nervous substance, marked by several indentations at its extremity (pes hippocampi). The inner border of the hippocampus major terminates in a narrow slip of white substance, called the corpus fimbriatum,

which is continuous with the posterior pillar of the fornix.

The *tænia semicircularis* is a whitish strip of nervous substance, which runs between the contiguous surfaces of the corpus striatum and optic thalamus. Anteriorly it is covered by a very delicate lamina of a yellowish colour; this is the *lamina cornea* of the tænia semicircularis.

The *fornix* is a flat, rather triangular-shaped band of medullary matter, which is placed between the septum lucidum and the third ventricle, from the latter of which parts it is separated by the tela choroidea. The inferior surface is marked by transverse lines, whence it is called *lyra*. The fornix terminates anteriorly in two pillars, which descend immediately *behind* the anterior commissure to the corpora mammillaria. The posterior part also divides into two pillars, which are amalgamated with the posterior extremity of the corpus callosum, and then branch off on either side to form the hippocampus major and minor.

By drawing backwards the tela choroidea, the *pineal gland* is brought into view, lying over the tubercula quadrigemina: this is a small mass of grey substance, which in the adult always contains one or two grains of a sabulous matter, composed of phosphate of lime for the most part.

The *tubercula quadrigemina* are four small eminences (the nates above, testes below), situate beneath the pineal gland and behind the third ventricle.

The *commissures anterior* and *posterior*, are two cord-like white bands, which run transversely in front of and behind the third ventricle. The anterior one runs in front of the pillars of the fornix, and penetrates the corpora-striata. The posterior commissure is much shorter; it lies in front of the tubercula quadrigemina, and *above the aqueduct* of Sylvius, and unites *the optic thalami*.

On removing the pia mater which covers the middle and fore part of the cerebellum, the *valve of Vieussens* is exposed—a thin plate of nervous matter, which forms the roof of the fourth ventricle, extending from the tubercula quadrigemina to the cerebellum; if the valve be broken down, the floor of the fourth ventricle, and part of the aqueduct of Sylvius, will be seen, with the *calamus scriptorius*, or collection of white transverse lines, supposed to be connected with the portio mollis.

The ventricles are lined by a distinct epithelial membrane—not by the arachnoid. The *third ventricle* of the brain is a narrow fissure, enclosed between the optic thalami, bounded above by the velum interpositum and fornix; below by the locus perforatus and tuber cinereum; in front by the anterior commissure and pillars of the fornix; and behind by the pineal gland, tubercula quadrigemina, and posterior commissure: at the anterior part is seen a small cavity (*foramen commune, foramen Monroi*), through which the lateral ventricles communicate with the third, and thus *indirectly* with each other: here also is another foramen, which leads to the *infundibulum*, a membranous prolongation, extending from the third ventricle to the pituitary body. From the posterior part, another foramen leads to a canal (*aqueduct of Sylvius, iter a tertio ad quartum ventriculum*), which forms a communication between the third and fourth ventricles. This canal passes backwards and downwards, beneath the tubercula quadrigemina, and above the pons Varolii.

The *fourth ventricle*, or ventricle of the cerebellum, is found at the extremity of the aqueduct, and concealed by the cerebellum. It contains a small choroid plexus, and is closed at the back part by a reflection of the arachnoid. The *fifth* ventricle is the smallest, *and is contained in* the septum lucidum.

Cerebellum. — The structure of the cerebellum

much more simple than that of the cerebrum; its tio to the latter is as one to eight in the adult. Its rface is marked by numerous concentric laminæ, alogous to the cerebral convolutions. It is divided to two lobes by the falx cerebelli. On the inferior rface is seen the *inferior vermiform process*, a small ɔule, situate in the median line. When the mass of e cerebellum is divided perpendicularly, an arrange- ent of the parts is seen, called *arbor vitæ*. This pends on the intermixture of white and grey matter. also contains a *corpus dentatum* or ganglion of grey atter enclosed in the white.

The cerebellum is connected to the cerebrum and inal marrow by two distinct bundles of nervous atter—viz., first, the processus a cerebello ad testes; cond, the corpora restiformia.

The first run up to join the corpora quadrigemina, id have the valve of Vieussens between them. The cond, or corpora restiformia, pass downwards and rm a union with the spinal cord. Besides these, large bundle of white fibres passes from each side of ie cerebellum to the opposite (forming the *pons arolii*) under the medulla oblongata.

BASE OF THE BRAIN.—At the base of the brain, the re at once recognises several distinct masses—viz., ie anterior lobes, the middle lobes, the pons Varolii, ith the medulla oblongata, and the inferior surface of ie cerebellum. The parts which occupy the median ne (reckoning from before backwards) are, the median ssure, the commissure of the optic nerves, the infun- ibulum, and tuber cinereum, the corpora mammillaria, he locus perforatus, and the pons Varolii.

We also observe the olfactory nerves; the *fissure* of *ylvius*, between the anterior and middle lobes: the ptic nerves, and their commissure. Behind this ɔmmissure, the infundibulum, tuber cinereum, and ɔrpora mammillaria. On either side of the latter, ie filaments of the third pair of nerves; the crura

cerebri passing to the cerebrum from the pons; the pons Varolii itself, with the fourth pair at its sides, and the thick roots of the fifth pair emerging from its substance; the sixth pair of nerves at the point of junction between the pons and medulla oblongata; and, finally, the medulla oblongata itself, or upper portion of the spinal cord.

The *pons Varolii* (*cerebral protuberance, tuber annulare*) is a square mass of nervous matter, convex on the lower surface, which unites the lateral lobes of the cerebellum. Under cover of it ascend to the cerebral hemispheres the *crura cerebri*, in the centre of which is a dark-looking portion of nervous matter, called, *locus niger*. They are prolonged inferiorly into the *anterior pyramidal bodies*. The inferior surface of the pons is formed of firm transverse fibres, most of which compose the *crura cerebelli*.

On separating the vessels and membranes, we find that a lozenge-shaped space is enclosed between the diverging crura cerebri, and the converging tractus optici. This space encloses the tuber cinereum, corpora mammillaria, locus perforatus, and origin of the third nerves. The corpora mammillaria (or *albicantia*) are little nodules of white matter, and are formed of the anterior pillars of the fornix, which descend to the base of the brain here. The locus perforatus is the floor of the third ventricle.

The *medulla oblongata* commences at the inferior edge of the pons, and is continuous with the spinal marrow. On the anterior surface, we see the median fissure separating the *anterior pyramids*, which are supposed to decussate nearly opposite the edge of the foramen magnum; these terminate superiorly in the crura cerebri, inferiorly in the anterior pillars of the spinal marrow; they are separated by a slight depression from the *corpora olivaria*, two oblong elevations of grey matter, enclosed by a medullary layer. In the centre of each olivary body is found a corpus dentatum.

which is contained in the vertebral
nds from the medulla oblongata (which,
ting, is a part of the spinal cord) to the
first or second lumbar vertebra. It
distinct swellings: one at the edge of
econd in the interval between the third
ical vertebræ, and a third corresponding
ween the tenth dorsal and first lumbar
ıe spinal cord is divided into two lateral
) anterior and posterior fissures. On
find two other fissures, less distinctly
g which the roots of the nerves are
ıe spinal marrow is suspended in the
by a peculiar membranous ligament
lentatum), which resembles the teeth of
ıt edge being attached to the pia mater,
lge to the dura mater, midway between
for the exit of the nerves. This liga-
separated from the arachnoid, which
insufflation.
of the brain accompany the smaller

vertebral and internal *carotid.* They are, the *anterior, middle,* and *posterior* cerebral arteries, and the *superior* and inferior arteries of the cerebellum. The internal carotid enters the skull by the foramen of the same name, and terminates in the anterior and middle arteries of the cerebrum and posterior communicating branch. The vertebral arteries enter by the foramen magnum, and soon unite to form a single trunk, the *basilar,* which terminates in the posterior cerebral and superior cerebellar arteries. The inferior artery of the cerebellum is generally derived from the vertebral trunk. At the base of the brain, a remarkable communication is formed, called the *circle of Willis,* which embraces the commissure of the optic nerves, and part of the tractus opticus, the infundibulum, and tuber cinereum, the corpora mammillaria, portions of the crura cerebri, the locus perforatus, and a small portion of the pons Varolii. This arterial circle is formed by the *anterior cerebral* and *anterior communicating,* and the *posterior cerebral* and *posterior communicating* arteries on either side. It does not enclose the roots of the third pair of nerves.

CEREBRO-SPINAL NERVES. — These nerves arise from the brain or spinal cord in pairs. They are symmetrical in their origin, and nearly so in distribution. They generally terminate by forming loops or plexuses.

The cerebro-spinal nerves consist of tubular or medullary matter, are united into bundles by a fine cellular tissue; and the bundles again are enveloped by a membrane called *neurilemma,* which is continuous with the pia mater.

CEREBRAL NERVES.—These are commonly arranged into nine pairs, denominated, according to their origins at the base of the brain (reckoning from before backwards,) first, second, third pairs, &c.

The first pair, or *olfactory,* is not a real nerve, but a *bulbous or ganglionic* prolongation of the brain. It

is triangular in shape, lies in a fissure between two cerebral convolutions, covered in by the arachnoid, and terminates in a bulb which lies on the cribriform plate of the ethmoid bone, and from which the real olfactory nerves are given off. It is said to *arise* by three roots; but more properly speaking, it is connected to the brain by three roots, two white and one grey. The two medullary roots are said to be connected with the corpus callosum and corpus striatum. The grey, or central one, arises from the posterior margin of the anterior lobe. The bulb sometimes contains a small ventricle. The *branches* descend through the cribriform plate, and are *distributed* to the mucous membrane covering the septum nasi and superior turbinated bones.

Second pair, or *optic.—Origin:* From the corpora quadrigemina and corpora geniculata. *Course:* Each winds round the crus cerebri in the form of a flat band, called *tractus opticus;* it then assumes a rounded form, receives a few fibres from the tuber cinereum, and unites with its fellow in front of the sella Turcica to form the *optic commissure*, in which both nerves are mingled, and interchange some filaments before their final distribution. *Distribution:* From the commissure, the optic nerves pass obliquely outwards to the foramina optica in the sphenoid bone through which they pass, and become remarkably diminished in size; they then penetrate the globe of the eye, internally and inferiorly to its centre, and terminate in the retina. Each nerve contains in its centre a very minute branch of the ophthalmic artery, called the *arteria centralis retinæ.*

Third pair, or *motores oculorum.—Origin:* From the locus niger in the crus cerebri, near the pons. *Course:* Along the outer wall of the cavernous sinus, above the other orbitar nerves; *then* through the sphenoidal fissure, *between the two* origins of the *external rectus muscles. Distribution:* To five out

of the seven muscles of the orbit, viz., To all the recti muscles (except the external), to the levator palpebræ, and inferior oblique: the terminal filaments of this nerve enter the *ocular* surfaces of the muscles.

Fourth pair; pathetici, trochleares.—Origin: From the valve of Vieussens, which is situated between the *processus a cerebello ad testes.* At their origin, they are connected by a distinct commissure. *Course.* Round the crus cerebri, then along the margin of the tentorium, through the outer wall of the cavernous sinus, and into the orbit by the sphenoidal fissure. *Distribution:* To the *orbitar* surface of the superior oblique muscle.

Fifth pair; trigemini, trifacial.—Origin: The fifth is analogous to a spinal nerve, and has two portions, one *anterior* and smaller, which is *motor;* another *posterior,* larger and coarser in texture, which is sensitive. The *motor* portion arises from the crura cerebri, or anterior pyramidal bodies—the *sensitive* from the crura cerebelli or restiform bodies. *Course.* The two portions run together over the edge of the petrous portion of the temporal bone, and there the posterior root forms the *Gasserian ganglion,* which gives off three branches; the anterior root continues its course *underneath* the ganglion, and joins its third branch before the latter has left the skull. The anterior root is composed of only five or six coarse filaments; the posterior contains about one hundred fine ones. *Distribution:* From the anterior edge of the Gasserian, or semilunar ganglion, three branches are given off—viz., I. The ophthalmic. II. Superior maxillary. III. Inferior maxillary.

I. The *ophthalmic* nerve runs along the outer wall of the cavernous sinus, and before it enters the orbit subdivides into three branches — 1. Frontal; 2. Lachrymal; 3. Nasal.

1. The frontal branch passes through the foramen *lacerum orbitale,* then runs between the periosteum

and levator palpebræ superioris, and divides into the (*a*) supra-trochlear and (*b*) supra-orbitar nerves. (*a*) The *supra-trochlear* passes out of the orbit *above* the oblique tendon to the occipito-frontalis, corrugator supercilii, and scalp. (*b*) The *supra-orbitar* nerve (external frontal) emerges through the supra-orbitar foramen or notch to the same parts as the former branch. Both these nerves are often the seat of neuralgic affections. 2. The *lachrymal* nerve runs along the upper edge of the external rectus muscle to the lachrymal gland; it also gives filaments to the skin and conjunctiva lining the upper palpebra. 3. The *nasal* nerve enters the orbit between the two origins of the external rectus, then crosses over the optic nerve, and divides into two (*a* and *b*) filaments: (*a*) the *internal*, or *proper nasal*, enters the internal ethmoidal foramen, then runs along the cribriform plate, and slips into a peculiar foramen at the side of the crista galli, and is distributed to the interior of the nares; some twigs emerge beneath the nasal bones, and are distributed to the skin at the tip of the nose. (*b*) The *infra-trochlear* branch of the nasal nerve runs along the superior oblique, but emerges *below* the trochlea, to be lost on the eyelids and parts about the lachrymal apparatus. Before its division, the nasal nerve gives off a branch to the *ophthalmic* ganglion, and two or three *ciliary* filaments.

II. The *superior maxillary* nerve passes through the foramen rotundum, crosses the spheno-maxillary fissure, then traverses the infra-orbitar canal, and having made its exit by the foramen of the same name, is lost on the cheek.

The principal branches of the superior maxillary nerves are—

1. An *orbitar* branch, subdividing into *malar* and *temporal*. 2. Filaments *to Meckel's ganglion*.

3. *Posterior superior dental nerves:* these wind *round the tuberosity of the superior* maxilla, enter

peculiar foramina, and supply the molar teeth. 4. *Anterior superior dental* nerve descends along the anterior wall of the antrum in its proper canal to all the remaining upper teeth. 5. *Infra-orbitar nerve.* This is the terminal branch, which comes out through the infra-orbitar foramen, and is distributed in malar, palpebral, nasal, and labial branches; it anastomoses freely with the portio dura.

III. *Inferior maxillary nerve*, the largest of the three branches, passes through the foramen ovale into the zygomatic fossa, where it becomes united with the non-ganglionic portion of the fifth nerve, and then divides into two branches, one (*a*) distributed to the muscles of mastication; the other (*b*), which is a sensitive nerve, to the tongue, teeth, and face.

(*a*) The *anterior*, or muscular, branch gives off, 1. *Temporal* branches, which pass out into the temporal fossa, and are distributed to the temporal muscle and behind the ear. 2. *Masseteric* branch, to the masseter muscle. 3. *Buccal* and *pterygoid* branches, to the buccinator and pterygoid muscles.

(*b*) The *posterior*, or sensitive branch, subdivides into three branches:—1. The *temporo-auricular* branch passes behind the neck of the lower jaw, is distributed to the parts about the ear, and finally accompanies the branches of the temporal artery. 2. The *inferior dental* nerve descends between the pterygoid muscles, then enters the inferior dental foramen on the inner side of the ramus of the lower jaw-bone, gives filaments to *all* the lower teeth, and sends a branch out by the sub-mental foramen on the chin, which is lost in the muscles of the lower lip and in the integuments. Before entering the dental canal, it gives off the *mylo-hyoid* nerve, which is distributed to the muscle of that name, the digastricus, and the sub-maxillary gland. 3. The *lingual*, or *gustatory*, branch of the inferior *maxillary nerve*, having been joined by the chorda *tympani, descends* between the sub-maxillary gland *and tongue, then* accompanies the Whartonian duct,

's up over the sub-lingual gland to terminate
ıcous surface of the tongue. This branch
ıe different salivary glands, the tonsils, the
:mbrane and papillæ of the tongue,* and sup-
ont half of that organ with the sense of taste.
air of nerves; abducentes.—Origin: From
edge of the pyramidal body, near its junc-
:he pons Varolii. *Course:* It runs forwards,
he posterior clinoid process; then through
nous sinus, crossing the *outer* side of the
ery; then into the orbit, through the sphe-
ure and between the two heads of the ex-
us muscle; and, passing along the *ocular*
this latter, is lost in its substance. In the
sinus it receives a few filaments from the
ervical ganglion.

pair of nerves comprises the *facial* and
erves—*portio dura* and *portio mollis.* The
a,† or *facial* nerve.—*Origin:* Arises from
part of the medulla oblongata, between the
ıd restiform bodies, and near the pons.

t and second divisions of the fifth nerve are purely
ıe *third division* is both motor and sensitive, like the
, which are like wise composed of a root provided
lion, and another on which no ganglion is formed.
ric, deep temporal, buccinator, pterygoid, and mylo-
hes, those given to the levator and tensor palati
the tensor tympani, which arise either directly or
om this division of the fifth, are motor; but the fact
teric nerves giving branches to the temporo-maxillary
shows that they contain sensitive fibres likewise. The
posterior portion of the third division of the fifth
the other hand, wholly composed of sensitive fibres.
:he special motor nerve of all the muscles of the face
ı of mastication excepted), the occipito-frontalis, the
he ear, the stylo-hyoid muscle, the posterior belly of
:us, and the platysma myoides. Sir C. Bell regards
s purely motor, and to preside over the respiratory
:he facial muscles. Professor Müller states, "that
l cause of the *sensibility of the* facial nerve is its
ı a *filament of the vagus in its course* through the
ueduct."

Course: It runs in company with the portio mollis, from which it is very frequently separated by a small artery, into the internal auditory foramen, and at the bottom of this latter enters the aqueduct of Fallopius, which it then traverses, comes out through the stylo-mastoid foramen, and is distributed, as will presently be seen, to the parts about the side of the face and head. In the aqueduct of Fallopius the facial nerve is joined by the petrous portion of the Vidian nerve; also by a communicating filament from the vagus. It gives filaments to the stapedius and tensor tympani muscles. On coming out from the stylo-mastoid foramen it gives, 1. A *posterior auricular* branch. 2. A *digastric* branch to the muscle of the same name. 3. *Stylo-hyoid* branch to the stylo-hyoid muscle.

Having distributed these filaments, the body of the facial nerve enters the substance of the parotid gland, and soon breaks up into two (*a* and *b*) principal divisions of branches, which communicate freely together, and form a mesh of loops called the *pes anserinus*. (*a*) The *temporo-facial* division ascends through the gland, across the condyle of the lower jaw, and divides into—1. *Temporal* branches, distributed to the muscles and integuments of the frontal, temporal, and auricular regions. 2. *Malar* branches to the integuments of the cheek and levators of the upper lip. 3. *Buccal* branches, to the muscles of the lips.

(*b*) The *cervico-facial* division passes downwards towards the angle of the lower jaw, and is lost in the integuments of the lower part of the chin and the neck. The whole of the branches of the facial nerve form anastomotic loops freely with each other, and with those of the fifth pair.

Portio mollis of the seventh pair; auditory nerve.—Origin: It arises from the floor of the fourth ventricle, and soon gains the portio dura, which it accompanies to the bottom of the f. auditor. internum. *Distribution:* Here it divides into—1. The nerve of the cochlea, which penetrates in numerous filaments to

the base of the cochlea, and is lost on the lamina spinalis and modiolus. 2. *Nerves of the vestibule* and *semicircular canals:* these are lost on the membrane lining the vestibule and semicircular canals.

Eighth pair of nerves, comprising the *glosso-pharyngeal, spinal-accessory*, and *pneumo-gastric* nerves. These divisions of the 8th and the 9th nerves likewise arise by successive filaments from the grooves of the medulla oblongata. *Origin:* The *glosso-pharyngeal* nerve* (*first division of the eighth*) arises, near the facial, from the upper part of the medulla oblongata, between the restiform and olivary bodies. It descends through the foramen lacerum posterius (*jugular foramen*), then crosses the jugular vein, and accompanies the stylo-pharyngeus muscle to the base of the tongue, in which it is ultimately lost. In its course this nerve gives—1. A branch of communication with the Vidian nerve. 2. Branches to the pharyngeal plexus. 3. Filaments to the hyo-glossus, tonsils, and epiglottis. 4. Filaments to the mucous follicles on the upper surface of the tongue.

Pneumo-gastric nerve; *nervus vagus*:† (*second division of the eighth.*)—*Origin:* Arises from the same por-

* This nerve has been considered as a nerve of motion, of sensation, and a compound nerve; it is most probably a nerve of associate function; that is, to associate all the parts engaged in the act of deglutition

† The vagus is evidently, in great part, a *nerve of sensation;* the filaments given to the stomach are completely so, since it is possible, by irritation of the vagus in the necks of animals, to excite contractions of the stomach. Immediately after the vagus has formed a ganglion, it receives a branch from the nervus accessorius; hence many physiologists suppose that the vagus derives the motor fibres, which are distributed in its branches to the larynx and pharynx, from this nerve. Professors Scarpa and Arnold have compared the vagus to a posterior, the spinal accessory to an anterior root; thus likening the origin of these nerves to the two roots of the spinal nerves. *The* experiments, however, of Professor *Müller and Dr. Reid prove* that the trunk of the vagus *contains within it motor filaments*, independent of *those which it receives from the internal* branch of the spinal accessory.

tion of the medulla as the preceding nerve, but a little below it. On passing through the foramen lacerum, the vagus presents a ganglionic enlargement; it then descends along the side of the neck, at first lying on the deeper-seated muscles, but soon enters the sheath of the carotid artery, in which it lies behind and between the carotid artery and internal jugular vein, and passes to the thorax; in the thorax it is found forming a plexus behind the root of the lungs, from which on either side the nerve again emerges, and, having passed down along the œsophagus, enters the abdomen by the œsophageal opening, to be lost on the stomach, liver and neighbouring parts. There is a slight difference between the courses of the right and left vagi, as they descend to and enter the thorax. The *right* nerve is placed more anteriorly than the left, and crosses between the subclavian artery and vein at a right angle on the inner side of the scalenus muscle; the *left* nerve crosses obliquely the origin of the subclavian artery, and then passes along the descending aorta.

The principal branches of the pneumo-gastric nerve are—

1. *Communicating* branches to the neighbouring nerves and the superior cervical ganglion. 2. *Pharyngeal* nerve, arising just below the ganglionic enlargement. This branch descends behind the internal and external branches of the carotid artery, in an oblique direction, to the middle constrictor of the pharynx, near which it forms the *pharyngeal plexus*, with branches from the spinal accessory, glosso-pharyngeal, superior laryngeal nerves, and superior cervical ganglion; from this plexus, filaments are sent off to the mucous and muscular tissues of the pharynx. 3. *Superior laryngeal**

* The *superior laryngeal* nerve is chiefly sensitive; the inferior *for the most part, motor.* Experiments on living animals show *that division of the* recurrent nerves puts an end to the motion *of the glottis, but that* the sensibility of the mucous membrane

given off below the former branch; it soon sub-
into two branches, one of which is distributed
xternal muscles of the larynx, the other pene-
etween the os hyoides and thyroid cartilage,
distributed to the arytenoid and crico-thyroid
; it also gives filaments to the epiglottis and
membrane in the neighbourhood of the rima

4. *Cardiac* branches, which descend to the
plexus. 5. *Inferior* or *laryngeal recurrent*
given off just as the vagus is about to enter the
that of the right side winds round the sub-
artery, from before backwards, and then
, obliquely inwards, to the trachea, until it
the edge of the inferior constrictor, under which
to be distributed to the crico-arytenoid, thyro-
id, and arytenoid muscles; it also gives filaments
ucous membrane. The *left* recurrent nerve is
han the right, and winds round the arch of the
. In the chest, the pneumogastric nerves descend
the posterior mediastinum to the root of the
where they break up and form the *pulmonary*
, from which a great number of filaments are
along the several ramifications of the bronchi.
hageal cords. From the inferior portion of
us on either side are given off the œsophageal
ne of which (*the left*) descends rather ante-
the other (*the right*) rather posteriorly—along
phagus, to the œsophageal opening in the dia-

that division of the superior laryngeal nerves leaves the
ts of the glottis unaffected, but deprives it of its sen-
Dr. Reid found that the internal branch of the superior
nerve was distributed almost entirely to the mucous
the epiglottis and interior of the larynx, and its ex-
anch to the crico-thyroid muscle, a few filaments being
to the inferior constrictor of the pharynx, and to the
id muscle; on the contrary, the *recurrent nerve* sends
laments to the mucous surface of the larynx; it is prin-
tributed to the *muscular fibres of the* trachea, to the
enoideus posticus, crico-arytenoideus lateralis, thyro-
us, and arytenoid muscles.

phragm, through which they pass, and terminate in the stomach, and in the solar and hepatic plexuses.

It may be remarked that the right recurrent nerve does not *always* pass round the subclavian artery. This occurs in certain cases of anomaly affecting this vessel.

Spinal accessory nerve; third division of the eighth.—Origin: This nerve arises below the vagus, by a series of filaments which are attached to the spinal marrow between the two roots of the cervical nerves, and often extend as low down as the fourth cervical. *Course:* The trunk of the nerve ascends through the foramen magnum, and thence passes to the jugular foramen, through which it makes its exit with the other divisions of the eighth nerve; on separating from the latter, it descends a little, then penetrates the posterior surface of the sterno-cleido-mastoid muscle, and is finally lost in the trapezius. *Distribution:* It gives various communicating branches, and supplies the trapezius and sterno-cleido-mastoid muscles. This is the superior external respiratory nerve of Sir Charles Bell, and presides over the respiratory actions of the muscles which it supplies.

Ninth pair; lingual nerves.—Origin: The lingual nerve arises from the fissure between the olivary and pyramidal bodies; it passes out through the anterior condyloid foramen, and, having crossed externally the branches of the carotid artery, turns upwards between the mylo-hyoideus and hyo-glossus muscles, to be distributed to the muscular structure of the tongue.

The chief branches are—1. *Descendens noni.* This branch descends along the sheath of the carotid artery to the omo-hyoid, sterno-hyoid, and sterno-thyroid muscles, forming a loop with a branch of the third cervical nerve. It is sometimes concealed *in* the carotid sheath, when it will be found running down *immediately* upon the carotid artery. 2. Branches *to all the muscles* at the base and body of the tongue.

Tabular View of the Origin and Distribution of the Cerebral Nerves.

	Origin.	Divisions.	Distribution.
I. Pair.—Olfactory	Corpus Striatum and Corpus Callosum (?)	External	To the lining of the Turbinated Bones.
		Internal	Septum of Nose.
II. Optic	Corp. Geniculata, Testis and Tuber Cinereum		To form the Retina.
III. Motores	Locus Niger, Locus Perforatus, and Crus Cerebri	Superior	Superior Rectus, Levator Palpebræ Superioris.
		Inferior	Inferior and Internal Recti, Inferior Oblique.
IV. Patheticus	Testis and Valve of Vieussens		The Superior Oblique.
V. Trifacial	Upper Part of the Medulla Oblongata	1st Division, or Ophthalmic	Frontal — Supra-trochlear, Supra-Orbitar.
			Lachrymal — Malar, Palpebral.
			Nasal — Infra-trochlear, Ciliary, Nasal.
		2nd, Superior Maxillary	Pterygo-maxillary — Orbitar, Dental.
			Sub-Orbitar — Dental, Malar, Palpebral, Nasal, Labial.
		3rd. Inferior Maxillary	Motor — Temporal, Masseteric, Buccal, Pterygoid.
			Sentient — Temporo-auricular, Inferior, Dental, Lingual, or Gustatory.
VI. Abducentes	Summit of Pyramidal body		External Rectus Muscle.

Tabular View of the Origin and Distribution of the Cerebral Nerves—continued.

	Origin.	*Divisions.*	*Distribution.*
VII. 1st Division, or Facial	Summit of Groove between Restiform and Olivary Bodies	Stapedius, Tensor Tympani, Posterior, Auricular, Stylo-hyoid.	
		Temporo-facial	Temporal, Malar, Buccal.
		Cervico-facial	Supra-mental. Infra-mental.
2nd Division, or Auditory	Floor of the fourth Ventricle	The Cochlea, Vestibule, and Semicircular Canals.	
VIII. Par Vagum	Groove between Olivary and Restiform Bodies	Pharyngeal, to Tonsils, and Epiglottis, Lingual, to base of Tongue.	
1st Division, or Glosso-pharyngeal			
2nd Division, or Pneumogastric.		Pharyngeal	Muscular and Mucous Tissues of the Pharynx.
		Superior Laryngeal	Thyro-hyoid, Crico-thyroid, Arytenoid, Mucous Membrane.
		Cardiac	To Heart.
		Inferior Laryngeal	Inferior Constrictor, Croco-arytenoidei, Thyro-arytenoidei, Arytenoid, Membrane of Larynx.
		Pulmonary Plexus	Tissue of Lungs.
		Gastric	Stomach.
		Cœliac	To Solar Plexus.
3rd Division, or Spinal accessory			Sterno-mastoid, Trapezius.
IX. Linguales	Groove between Pyramidal and Olivary Bodies		Descendens noni, Muscles of Tongue.

SPINAL NERVES.

The spinal nerves consist of thirty pairs—viz., eight cervical, twelve dorsal, five lumbar, and five sacral. Each spinal nerve arises by two *roots* separated by the ligamentum dentatum from the lateral surface of the spinal marrow, the anterior or motor *root* from the anterior or pyramidal column, the posterior or sensitive from the posterior or restiform column—the latter soon forms a ganglion. The two roots pass out through the intervertebral foramen, and here unite to form a single spinal nerve of compound function. The nerve almost immediately divides into an anterior and posterior *branch*—the anterior layer proceeds forwards to form the principal plexuses, the posterior passes backwards and is lost in the lumbar mass of muscles.

The *first* cervical (*sub-occipital*) nerve passes between the occipital bone and atlas, crosses the vertebral artery, and is distributed to the muscles at the back of the neck and occiput. The other superior cervical nerves give branches to the muscles which lie in their neighbourhood, communicate with the sympathetic nerve, and form, through means of their *anterior* branches, the cervical plexus. The *phrenic* arises from the third, fourth, and fifth cervical nerves; it descends along the scalenus anticus muscle, then enters the thorax, passes along the side of the pericardium, and is distributed to the diaphragm. The phrenic nerves also send filaments to the solar plexus, and to the liver; and it is supposed that the pain in the right shoulder felt in liver diseases, arises from the irritation of the terminal twigs of the phrenic, propagated upwards to the spinal cord, and thence reflected along some of the nerves which arise in the vicinity, and which supply the shoulder. This is the *inferior internal respiratory* nerve of Sir Charles Bell.

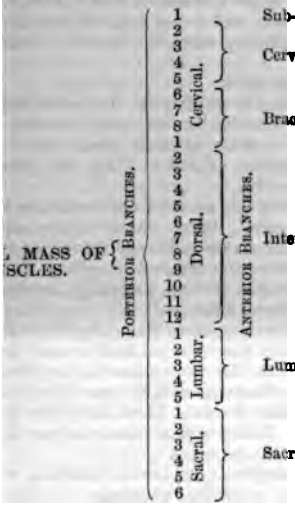
The *four inferior cervical nerves* together with the first dorsal, form the *axillary* or *brachial* plexus, which gives off the thoracic, scapular, and brachial nerves. These latter comprise the circumflex, internal cutaneous, external cutaneous, median, ulnar, and musculo-spiral. The filaments of the internal cutaneous nerve, which cross the median basilic vein, are those liable to be injured during the operation of phlebotomy.

The *dorsal* nerves are twelve pairs; like the other spinal nerves, they divide, on leaving the intervertebral foramina, into two branches: the posterior form the dorsal, properly so called; the anterior constitute the intercostal nerves.

The *lumbar nerves* are five pairs; being joined by a branch from the last dorsal, they form the lumbar plexus, which furnishes the musculo-cutaneous, inguino-cutaneous, genito-crural, anterior crural, obturator, and lumbo-sacral nerves.

The *sacral nerves*, in conjunction with the lumbo-sacral, form the sacral plexus, from which branches are distributed to the viscera of the pelvis, the organs of generation, and the lower extremities; viz., the hæmorrhoidal, vesical, uterine and vaginal branches; the lesser and greater sciatic, inferior glutæal, posterior cutaneous, and pudic.

ular Distribution of the Spinal Nerves.



ATHETIC NERVE. (*Nerve of organic life.*)

sympathetic nerve, great intercostal, or *tri-mic,* is a nervous and ganglionary cord, which front of the vertebral column, and extends from d to the pelvis; it forms a distinct portion of rvous system, although connected by twigs or ith all the spinal nerves and some of the cere-; furnishes twigs to all the arteries, and to the of the trunk. *The sympathetic* consists, as ap-*nder the microscope, of* pale fibres, grey in

colour and gelatinous in consistence, and very different from the ordinary white nerve tubes. The ganglia of the sympathetic nerve are situated in the *cephalic, cervical, intercostal, lumbar,* and *sacral* regions, and are named accordingly, cephalic, cervical, thoracic, abdominal, and pelvic.

(*a*) *Cephalic ganglia.*

1. Some filaments which pass from the cavernous ganglion to the anterior cerebral arteries unite on the communicating branch between these two vessels, forming the *ganglion of Ribes.* This ganglion, however, is rarely found.

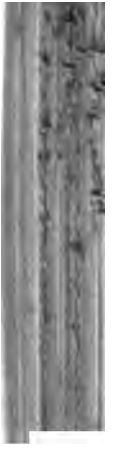
2. Ganglion of *Bock,* or *carotid plexus;* this is found in the carotid canal, lying on or surrounding the artery; it communicates inferiorly by one or two filaments with the superior cervical ganglion, and superiorly with the nasal, Vidian, and sixth nerves; also with the ganglion of *Ribes.*

3. The *ophthalmic,* or *lenticular ganglion* is found in the orbit between the external rectus and the optic nerve; it furnishes the *ciliary* nerves, and communicates by distinct filaments with the nasal branch of the fifth and the third nerves. These have been denominated its *roots.* This ganglion also receives filaments from the sympathetic system.

4. The *otic ganglion* (ganglion Arnoldi) is a small, reddish-grey, soft ganglion, situated a little below the foramen ovale, on the inner side of the third branch of the fifth nerve, between this and the Eustachian tube. Two nerves come off from this ganglion, one of which is distributed to the tensor tympani muscle, the other, the nervus petrosus superficialis minor, enters a special canal in the temporal bone in front and to the outer side of the aqueduct of Fallopius, passes through this canal into the cavity of the tympanum, and joins the tympanic plexus of Jacobson. The otic ganglion communicates with the third division of the fifth nerve.

5. The spheno-palatine (*Meckel's*) ganglion is found

ranch of the opposite side, and be lost on the
It sometimes, but rarely, forms here the
of *Cloquet*. It next gives off (*d*) the—
nerve: this passes backwards through the
canal, and divides into two filaments; one of
is the carotid plexus; the other enters the
of Fallopius, and joins the facial nerve,
accompanies to within two lines of its exit at
nastoid foramen. The Vidian nerve at this
s forward into the tympanum, where it runs
ne long process of the incus and the handle
leus, assuming the name of *chorda tympani*.
ierges at the Gasserian fissure, inclines for-
inwards, and comes in contact with the
nerve, which it accompanies until it ap-
he submaxillary gland; it then separates
gustatory, descends on the submaxillary
which it divides into filaments, forming a
rus. A *ganglion* (the *submaxillary*) is found
nd. This ganglion is situated on the lingual
he third division of the fifth; it resembles
almic ganglion in being composed both of



glion is sometimes wanting, or merely consists of a slight swelling of the nerve. The branches of the *superior* cervical ganglion are—

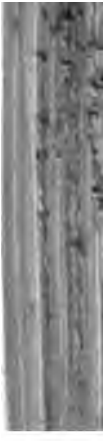
1. *Ascending.* To form the carotid plexus in the carotid canal.
2. *Descending.* To the middle cervical ganglion, also branches which form the *superficialis cordis* nerve.
3. *Anterior.* To communicate with the facial, lingual, pneumogastric, and glosso-pharyngeal nerves. The fine filaments which run along the external carotid and its branches are termed *nervi molles.*
4. *External.* To join the anterior branches of the four superior cervical nerves.
5. *Internal.* To join laryngeal nerves and pharyngeal plexus.

The *middle* cervical ganglion lies on the longus colli muscle, opposite the body of the fifth or sixth cervical vertebra. It gives off—

1. *Descending.* Two or three filaments to inferior ganglion of neck.
2. ,, Middle *cardiac* nerve, to the heart.
3. *External.* To anterior branches of the fourth and fifth cervical nerves.
4. *Internal.* To thyroid artery and gland, trachea, and œsophagus.

The *inferior* cervical ganglion is found between the transverse process of the last cervical vertebra and the neck of the first rib; it gives off—

1. *Ascending* and *descending* filaments to join the two neighbouring ganglia; a distribution which is found in all the other ganglia of the sympathetic, and therefore need not be noticed again.
2. *Internal* filaments to the pulmonary plexus, recurrent, and phrenic nerves.



l. Which follow the internal mammary and
clavian arteries; a large plexus of nerves
n this ganglion ascends on the vertebral, and
r be traced even to the basilar artery.

diac ganglion (*plexus cardiacus*, Haller)
m the arch of the aorta and the bifurcation
chea, in close contact with the former, ex-
om the division of the pulmonary artery to
of the brachio-cephalic. It is rounded and
from half to three-quarters of an inch long,
more; its colour is that of mother-of-pearl.
rance of a plexus which it presents is owing
merous branches which it receives at its
emity and gives off at its lower.
his ganglion *three orders* of filaments are
-

nents to join the pulmonary plexuses.
rial branches to the aorta, and large arteries
rom it.
ending branches to the heart; these are dis-
o sets, which take the course of the coronary

pulmonary filaments to the plexus of that name, and *arterial* filaments to the aorta. The principal branches, however, are the *greater* and *lesser splanchnic* nerves. 1. The *greater splanchnic* nerve arises from the 6th, 7th, 8th, 9th, and sometimes 10th thoracic ganglia; it descends through the crus of the diaphragm, and joins the semilunar ganglion. 2. The *lesser splanchnic* nerve is derived from the 10th and 11th thoracic ganglia; it passes through the crus of the diaphragm to join the renal plexus.

ABDOMINAL GANGLIA.—These may be distinguished into lumbral and sacral. The *lumbar* ganglia are usually five pairs, situated on the sides of the bodies of the lumbar vertebræ, near the psoas magnus muscle; beside communicating and arterial branches, they send off filaments to the various plexuses to be mentioned hereafter.

THE SACRAL GANGLIA are commonly three or four pairs, situate near the anterior sacral foramina; they send off filaments to the sacral nerves and hypogastric plexus. The last pair detach two filaments which pass obliquely inwards and form the *ganglion impar*, on the median line.

ABDOMINAL PLEXUS.—The various branches of the *abdominal ganglia*, being joined by the splanchnic and branches of the par vagum, form numerous plexuses for the viscera of the abdomen and pelvis. 1. The *Solar Plexus* lies on the crura of the diaphragm and across the aorta, near the cœliac axis; in its meshes may be seen the *semilunar* ganglia. This plexus gives off, or, more properly speaking, is in close communication with, the *phrenic, gastric, hepatic, splenic, renal, spermatic*, and *mesenteric* plexuses, which accompany the vessels corresponding with their several names. 2. The *Hypogastric* plexus is a vast interlacement of filaments derived from the spinal and *sympathetic* nerves which surround the internal iliac *arteries, and supply* the different viscera of the pelvis.

ORGANS OF SENSE.

A description of the organs of sense naturally follows that of the nervous centres. They are five in number; viz., the skin (or organ of *touch*); the tongue (*taste*); nose (*smell*); eyes (*vision*); ears (*hearing*).

THE SKIN OR ORGAN OF TOUCH.

The skin is the external integument which covers the whole body, and is continuous with the mucous membrane, and with the lining of the ducts of the secreting glands.

The structure of skin and of mucous membrane is identical, although the component parts are differently modified in different situations. The most external layer is called *cuticle* in the skin, and *epithelium* on mucous membrane. Under this lies a simple structureless, transparent and very thin membrane, called *basement membrane* by Mr. Bowman; and this again lies upon a more or less dense layer of areolar tissue, called in the skin the *chorion* or *cutis vera*, permeated by blood vessels, which are generally most abundant on its surface immediately under the basement membrane. Besides these the skin possesses *sweat glands*, *sebaceous follicles*, *hair*, and *nail*, and *minute papillæ*.

The cuticle or epidermis is composed of an immense number of minute scales agglutinated together, which are being perpetually worn off from the outer surface, and as perpetually secreted from below by the cutis vera. The newest layer of scales, which are in immediate contact with the cutis vera, are softer, rounder, and different in some chemical respects from the outer ones, which have become harder and flatter. The innermost layers of cuticle *where it is* the softest, are called *rete mucosum, and it is in these* layers that *the pigment is found which causes* the dark tint of

negroes and of dark complexions in general. The pigment seems to lose its tint as it approaches the surface. The outer surface of the epidermis exhibits its cellular constitution, the papillæ and apertures of the sebaceous and sudoriferous glands; on the inner surface are seen the funnel-like ducts of these.

The *basement membrane* is only known through the microscope, as forming the boundary between the cutis vera and cuticle.

The *cutis vera* is formed of a dense web of white and yellow filamentous or cellular tissue; which is united by ramifications with the subcutaneous areolar tissue, and often with the fascia beneath. The thickness of this part depends on the amount of pressure it has to withstand, and the thickness of the cuticle is in the same proportion. The vessels and nerves of the skin pass through it to ramify on the surface.

The *papillæ* of the skin are minute elevations of its surface (about 100th of an inch long) found wherever the sense of touch is most delicate, as on the fingers, where they exist in curved double rows. They are composed of a capillary artery and vein, forming a loop, with a very minute portion of cellular tissue; a nervous loop probably exists also in them, as it does in the fungiform papillæ of the tongue; but it has not been clearly demonstrated with the microscope. They are covered with an expansion of the basement membrane, and over that with a cuticle, which is often moulded into ridges corresponding with the rows of papillæ.

The *sweat glands* lie thickly under every part of the skin, especially in the axilla. They are lodged in little foveolar depressions on the deep surface of the skin, and are of pink colour and semi-transparent appearance. Their ducts pass through the cutis and cuticle in a spiral form; and their orifices are easily discernible in the fingers, in the cross grooves which intersect the rows of papillæ. They are composed of an invo-

tion of basement membrane, in the form of a tube lled up into a little ball ; and are lined with an epi- elium continuous with the cuticle. When the cuticle stripped off from the cutis vera, the minute ducts of e sweat glands can often be seen to be drawn out om the latter.

The *sebaceous follicles* are little pouches secreting a ty matter, found most abundantly in the nose, lips, rotum, &c.

The hairs and nails are modifications of the cuticle. *de* Todd and Bowman's Physiology for a minute count of their structure.

THE TONGUE, OR ORGAN OF TASTE.

The tongue is contained in the mouth. It is princi- lly composed of muscular and vascular tissues. The scles which enter into the composition of the tongue , the *linguales*, the *genio-hyoglossi*, the *stylo-glossi*, d the *hyo-glossi*. In addition to these, there are merous muscular fibres to which no distinct names ve been given. The superior constrictor of the arynx and palato-glossi muscles are attached to the ngue. The upper surface of the tongue is marked by nedian line, or raphe ; and near its base may be seen depression, or hole (*foramen cæcum*).

Three kinds of papillæ are distinguishable on the rface of the tongue. First, the *papillæ caliciform* pillæ vallatæ, or circumvallatæ), about a dozen in mber, which extend in a double row across the ngue in a V shape, the angle being formed by the *amen cæcum*. These are large and flattened, and rrounded with an elevated ring of mucous membrane, ence their name. Secondly, the *fungiform papillæ*, ich are most abundant at the sides and tip, and y sparingly scattered on the *dorsum*. These are tinguished by *their red colour, because* their invest- *epithelium is so thin that the blood is* seen through

it. Thirdly, there are the *papillæ conicæ vel filiformes*, by which the major part of the tongue is covered. These are whitish and covered with a dense epithelium, which, when accumulated in unnatural quantity, constitutes the *fur* of the tongue. Each of these three kinds of visible papillæ is thickly studded on its surface with minuter simple papillæ, whose texture is the same as that of the papillæ of the skin. Between the row of *circumvallate papillæ* and the epiglottis, the surface of the tongue is smooth, but contains numerous papillæ under its epithelium. The proper structure of the tongue is generally supposed to be of an erectile tissue, and is largely supplied with blood-vessels; it is separated into two lateral portions by an imperfect raphe of a fibrous character.

The principal blood-vessels of the tongue are the lingual arteries, derived from the external carotids. Its nerves are, the ninth, the glosso-pharyngeal, and the gustatory branch of the fifth nerve.

The *soft palate* (*velum pendulum palati*) separates the cavity of the mouth from that of the pharynx. It consists of five pairs of muscles, enclosed between mucous membranes; the central depending portion is called the *uvula*. The names of these muscles (which also denote their offices) are, *levator palati*, *tensor palati*, *motor*, or *azygos uvulæ*, *palato-glossus*, and *palato-pharyngeus*, or *constrictores isthmi faucium*.

On either side of the soft palate are placed the *amygdalæ* (*tonsils*), which are small oval-shaped bodies, composed of an aggregation of mucous follicles, and placed between the palato-glossus and pharyngeus muscles.

The *salivary glands* are three in number (on each side), viz., the parotid, submaxillary, and sublingual.

The *parotid gland** is the largest of the salivary

* *In mammalia*, the form in which a salivary gland first appears *is, according to* Weber and Müller, that of a simple canal with *bud-like processes*, lying in a gelatinous nidus, and communicat-

glands. It is situated partly before and partly beneath the external ear, filling up the deep excavation which exists on the sides of the face, between the posterior edge of the ramus of the lower jaw, the meatus auditorius externus, and the mastoid process of the temporal bone. It extends vertically from the zygomatic arch to the angle of the lower jaw.

Its *outer surface* is covered by some fibres of the platysma myoides and by the skin, under which ramify some nervous filaments.

The *anterior surface* corresponds above to the articulation of the inferior maxilla, externally to the posterior edge of the same bone, and internally to the pterygoideus internus muscle. Its *posterior surface* is connected by pretty dense cellular tissue with the meatus auditorius externus, the mastoid process, the anterior edge of the sterno-cleido-mastoideus, the posterior belly of the digastricus, the styloid process, and the muscles which arise from it. The duct of the gland (*ductus Stenonis*) arises by minute radicles in the granules, and taking a transverse course, passes forwards on the masseter, and pierces the buccinator muscle and the mucous membrane of the mouth opposite the second molar tooth of the upper jaw. In its course, the parotid duct receives, about the middle of its length, another duct, which proceeds from a glandular body (*socia parotidis*) placed in its vicinity. The parotid duct perforates the buccinator muscle *perpendicularly*. The parts contained in this gland

ing with the cavity of the mouth. As the development of the gland advances, the canal becomes more and more ramified, increasing at the expense of the germinal mass in which it is still enclosed. In the first stage of their development, the salivary ducts can be seen to constitute an independent closed system of tubes; in the adult, these tubes communicate with minute cells, which, when filled with mercury, have a diameter about three times greater than that of the *capillary blood*-vessels, and are united into small *grape-like bunches or lobules*, which are from four *to seven times larger than the cells themselves*.

are, the termination of the external carotid artery, the commencement of the external jugular vein, and the facial nerve.

The *submaxillary gland* is placed beneath and behind the lower jaw, resting on the mylo-hyoideus muscle; its upper surface is marked by the passage of the facial artery, and it sends off a duct (*Wharton's duct*) which ascends obliquely upwards to the frænum linguæ, at the side of which it terminates.

The *sublingual gland* lies close under the tongue, on either side of the frænum, between the genio-hyo-glossi and mylo-hyoidei muscles; it communicates with the cavity of the mouth by several minute orifices, and sometimes by one or two small ducts which join the Whartonian duct.

The *pharynx* is a musculo-membranous sac, continuous on one side with the mouth, on the other with the œsophagus. The roof of the pharynx is formed by the under surface of the basilar process; it lies on the bodies of the five superior cervical vertebræ, and its sides are composed of the three constrictors, the stylo-pharyngeal and palato-pharyngeal muscles. There are seven openings into the pharynx—viz., the *isthmus faucium* (from the mouth); the *posterior nares* (from the nostrils); the *Eustachian* tubes (from the tympani); the *glottis* (from the larynx); and finally, the communication with the œsophagus.

The *œsophagus* is a musculo-membranous canal which connects the pharynx with the stomach; it descends at first behind the trachea, then in the posterior mediastinum, behind the pericardium, and upon the aorta; and lastly, passes through the œsophageal opening of the diaphragm. The œsophagus consists of mucous and muscular coats; the muscular fibres are chiefly longitudinal; a few circular are found about the cardiac extremity. The mucous membrane of the *fauces and œsophagus* is lined by a dense epithelium,

ich protects it from the contact of foreign bodies, d is frequently raised by disease or accident into ications.

The *teeth*, in the adult subject, are thirty-two in mber, sixteen in each jaw; they are divided into ɔ *incisores*, *cuspidati*, *bicuspidati*, and *molares*. ere are in each jaw *four* incisors, *two* cuspidati, ır bicuspid, and *six* molar teeth. Each tooth is mposed of a *crown* (or projecting part), a *neck*, and a ıg or root. The crown is covered by a very hard bstance denominated *enamel*, and its base contains cavity which is lined by the dental *pulp*, which ıaives vessels and nerves through a canal in the root. ıe incisor and cuspidati teeth have single roots; the ıuspids are distinguished by their double roots; the ɔo anterior molars of the upper jaw are furnished th *three* roots; the rest (with the exception of the *ıtes sapientiæ*) have usually only two.

In the child, up to the age of seven or eight, there ɔ only twenty teeth—viz., four incisors, two cuspiti, and four molar teeth in each jaw.*

The teeth under the microscope appear to be comsed of an external coating, the *enamel* or *cementum*. middle portion, the *dentine*, is composed of fibrous bes radiating from the vertical canal in the centre to ɔ cementum; the central canal is open inferiorly, and ıs admits of the entrance of the vessels and nerves the pulp of the teeth in its interior.

* The deciduous, temporary, or milk-teeth, appear above the ns nearly in the following order: the central incisors of the ver jaw about the end of the sixth, or beginning of the seventh nth; a few weeks after, the central incisors of the upper jaw: ır these, the lateral incisors above or below, without deterıate order; and between the 12th and 18th months, the first r of molars, either above or below. These are succeeded by the er canine (cuspidati) teeth, and about the second year, by the ıer. About the end of the second *year*, or *in* the course of the rd, the second *pair of molar teeth cut the* gum.

THE NOSE, OR ORGAN OF SMELL.

The nose may be distinguished into two parts, an external and internal. Of the external it need only be said, that the solid materials are composed of cartilage and the ossa nasi; the whole cavity of the nose is subdivided into two lateral portions by the vomer, perpendicular plate of the ethmoid, and cartilage. Each nostril is further separated by the *spongy* or *turbinated* bones into superior, middle, and inferior *meatus*. The following are the openings into the nasal cavity: into the *superior meatus* open the posterior ethmoidal cells and the sphenoidal sinuses; into the middle meatus open anterior ethmoidal cells, the frontal sinus, and the antrum; into the *inferior meatus*, we find the opening of the nasal duct: in addition to these, the nose communicates externally with the atmosphere through the nostrils, and internally with the pharynx through the posterior nares; hence, when a person weeps, acts of deglutition are often observed, because the tears escape through the lachrymal points into the nasal duct; thence into the inferior meatus, and from the meatus pass through the nasal fossæ into the pharynx. The cavity of the nose is lined throughout by the *pituitary* membrane, and receives branches from the olfactory nerve, which supplies the sense of smell:—from the first and second divisions of the fifth, which supply common sensation; and from Meckel's ganglion, which seems to establish a sympathy between the nose and the respiratory apparatus.

THE EYE, OR ORGAN OF VISION.

The *eye* is contained in a long cavity, called the *orbit*, which is composed of the frontal, superior maxillary, malar, ethmoid, sphenoid, lachrymal, and palatine *bones*. The muscles enclosed in the orbit are, the *levator palpebræ* superioris, the four recti, and two

oblique muscles. The nerves of the orbit are, the second, third, fourth, the first division of the fifth (*ophthalmic*), and the sixth nerve.

The *globe* of the eye is composed of fluid and solid parts enclosed in certain membranes, or tunics. The latter are, the sclerotic, the choroid, and the retina.

The *sclerotic* coat is a strong fibrous membrane, enclosing nearly four-fifths of the eye, and united anteriorly to the cornea in a bevelled manner. Its inner surface is in contact with the choroid membrane. The external surface of the sclerotic is covered anteriorly by the conjunctiva and expansion of the tendons of the ocular muscles. It is penetrated posteriorly by the optic nerve and central artery of the retina, and on the sides by the ciliary nerves and vessels.

The *cornea* is a transparent membrane, nearly circular, attached to the sclerotica, and forming the anterior portion of the eye-ball. It is composed of several laminæ containing a serous fluid between them; it is lined anteriorly by a very thin layer of conjunctiva, and posteriorly by the membrane of the aqueous humour. The cornea in health does not contain any vessels or nerves.

The *choroid* membrane is a vasculo-cellular coat placed between the sclerotic membrane and the retina, being continuous anteriorly with the ciliary ligament, where it is thrown into longitudinal folds, called the *ciliary* processes. The choroid is covered on both surfaces, but more particularly on the internal, by a dark secretion, called the *pigmentum nigrum*; and its veins, which generally ramify along the external surface, are denominated *vasa vorticosa*. The *internal* lamella of the choroid is named the *tunica Ruyschiana*.

The *ciliary ligament* is a greyish ring which surrounds the circumference of the iris, serving as a bond of union between this structure, the choroid, and sclerotica.

The iris is a kind of septum, placed vertically in the

midst of the aqueous humour. Circular and flat, it separates the *anterior chamber* of the eye from the *posterior chamber*, which is limited behind by the crystalline lens. In the centre of the iris, an aperture called the *pupil*, exists; its dimensions are continually varying, but its mean diameter is about two lines. The *anterior surface* of the iris is covered by the membrane of the aqueous humour; its *posterior surface* has received the name of *uvea*, and is covered with black pigment. The *great circumference* of the iris corresponds from without inwards to the ciliary circle, the choroid membrane, and the ciliary processes. Its *small circumference* forms the limits of the pupil.

The iris is composed of *two* laminæ, intimately united at the pupil, but easily separable toward the circumference. Several anatomists admit the existence of muscular fibres in the iris, two sets of which are generally described—an outer, *radiated*, broad, corresponding to the outer coloured ring, and dilating the pupil; an inner, narrower, composed of *circular* fibres, which contract the pupil in the manner of a *sphincter*. In the fœtus, up to the seventh month of gestation, the pupil is closed by a membrane (*membrana pupillaris*).

The nerves of the iris are the ciliary, derived principally from the ophthalmic ganglion. It has been proved by experiments that the *motor* power of the ciliary ganglion and nerves is derived from the third nerve, and that the light does not cause the contraction of the pupil by acting directly on the ciliary nerves, but that irritation of the retina and optic nerve acts immediately upon the brain, and from the brain is reflected upon the third nerve and the short motor root of the ciliary ganglion. The long root of the ciliary ganglion, from the nasal branch of the fifth, supplies the interior of the eye with *sensibility*. The *nutrition* of the eye *is under the influence* of its nerves; for if the superior *cervical ganglion*, or if the ophthalmic nerve be de-

stroyed, inflammation of the eye, with effusion of lymph, ensues.

The iris is supplied with blood by the short and long ciliary arteries which are given off from the ophthalmic; the *short* perforate the sclerotic coat near to the optic nerve, run forward between this and the choroid coat, in which they are principally lost; the *long* pass forwards between the sclerotic and choroid, and having arrived at the ciliary body, each artery divides into branches, which, passing through the ciliary ligament, subdivides, and, by numerous inosculations with each other, and with small arteries which perforate the sclerotic near the cornea, form a perfect circle of blood-vessels, at the circumference of the iris; from this circle proceed branches like rays towards a centre, which, subdividing and anastomosing, form a complicated network, or a second circle within the former; and from the concavity of this proceed small branches, which run and subdivide in the same manner, and, uniting again, form another circle, smaller than either of the former, and very near to the opening of the pupil. The veins of the iris open into the vasa vorticosa and the long ciliary veins.

The *ciliary processes* are small vascular membranous prominent bodies, placed beside each other in a radiating manner, so as to form a ring like the disc of a radiated flower; this surrounds the crystalline lens in the manner of a crown placed behind the iris and ciliary circle, in particular depressions on the fore part of the vitreous body. The ring which results from the union of the ciliary processes is called the *ciliary body*. The number of ciliary processes vary from sixty to eighty. Each lamella, or process, is triangular; one side looks forward to the iris, the other backward to the crystalline lens and vitreous humour. The intervals between the processes are filled up by a pigment similar to the *pigmentum nigrum in* every particular. The *ciliary processes are not* merely in contact with

the anterior part of the hyaloid membrane, but are connected with it by small plicæ of the latter, which project into the interstices between the processes; by some they are supposed to be muscular.

The *anterior* chamber of the eye is the space comprised between the anterior surface of the iris and the cornea; the *posterior* chamber is the space situated between the iris and anterior surface of the lens. The *aqueous* humour is contained in both these chambers; it is a clear fluid, very readily reproduced when evacuated, and amounting in weight to five or six grains. The membrane of the aqueous humour lines the anterior chamber.

The *vitreous humour* is a semi-fluid transparent body contained in the cells of the *hyaloid* membrane, and situated behind the lens. The hyaloid membrane is in contact with the inner surface of the retina, and anteriorly it divides into two layers to embrace the crystalline lens. There results from this separation a space of the form of a three-sided circular prism, completed by the circumference of the lens; this *is the canal of Petit.**

The *crystalline lens* is situated at the union of the anterior with the two posterior thirds of the eye, lying behind the iris, surrounded by the ciliary processes, and received into a cavity of the vitreous humour. The crystalline lens, which is perfectly transparent in the adult, is a little reddish in the fœtus, and yellowish in old persons. Its softness diminishes as the age advances. The *capsule* of the lens has a form similar to the body it contains; it is a sort of sac, which is itself

* The structure of the hyaloid membrane is as yet but little known. Its cells all communicate together, so that when an aperture is made into one, the whole of the vitreous humour may be drained out. The annulus, or disc, of the hyaloid membrane, which corresponds to the ciliary processes, is named the *zonule of Zinn*; on this may be observed a number of dark lines converging like radii, and disposed in the form of a disc round the [illegible]

lged in a reduplication of the hyaloid membrane, om which it may be easily separated at the edges, it anteriorly and at the centre these membranes are timately united. Between the lens and its mem-ane is found the *liquor Morgagni*, a slightly viscous uid, which escapes the moment the capsule is opened. The *retina* is a transparent membrane which lines e inner surface of the choroid, and is continued as r forward on the vitreous humour as the ciliary pro-sses. It is composed of three layers—viz., the ex-rnal, *serous*, or *Jacob's membrane;* the middle, or *rvous* layer; and the internal, or *vascular* layer. he *central spot* of the retina, or yellow spot of Sœm-ering, is a circular fold placed in the axis of vision, out two lines externally to the point where the optic erve joins the retina. The *vascular layer* of the tina lies internal to the nervous layer, between it id the vitreous humour. It is supplied by the *arte-a centralis retinæ*, a minute branch of the ophthalmic hich runs in the centre of the optic nerve, and nerges from its termination to form this vascular et-work which lines the retina. A disturbance of the rculation in these minute vessels is supposed to be ie cause of the black spots or flushes of fire which ppear before the eyes in dyspepsia and amaurosis.

Having thus briefly described the organ of vision self, I may notice its appendages. These are, the yebrows, eyelids, and lachrymal apparatus. The achrymal apparatus consists of the lachrymal gland nd caruncle, the lachrymal ducts and sac, and the asal duct.

The *lachrymal* gland is placed in the fossa of that ame at the superior and external angle of the orbit. t is composed of several lobules, from which are iven off a number of small ducts, and these, uniting nto trunks (generally seven) *open in the* fold of con-nctiva which *passes from the upper* eyelid to the *yeball at its upper and outer part.*

The *caruncula lachrymalis* is a reddish tubercle, situate at the inner angle of the orbit, and composed of a number of mucous follicles. In front of the caruncula, in the margin of each lid, may be seen the small eminences on which are placed the *puncta lachrymalia;* these points are the external orifices of the lachrymal ducts, which pass along the eyelids to terminate in the lachrymal sac. The latter is a membranous sac, lying behind and beneath the tendon of the orbicularis muscle, and in the fossa formed between the os unguis and ascending process of the maxillary bone; it is continuous with the *nasal duct*, which descends obliquely downwards, backwards, and a little outwards, along the maxillary bone, and opens into the inferior meatus of the nose.

PHYSIOLOGY OF VISION.—The rays of light from any given object are collected by the cornea, in consequence of its forming a concavo-convex lens, and are directed towards the interior of the eye. Some impinge upon the iris, and become reflected, exhibiting the colours of this membrane. The greater number pass through the pupil, and are concentrated by its double convexity; they pass backwards from its posterior surface through the vitreous humour, and here diverging form the image of the object on the retina, the direct or vertical rays pass straight through the lens; the lateral rays in passing through the lens and vitreous humour diverge, so that the object is formed in an inverted position on the retina. A too great convexity of the lens causes the image to fall short of the retina, and insufficient convexity to form beyond the retina, hence the phenomena of near and far-sighted persons. These defects are remedied by the use of glasses, which correct the deficiency in the natural structure.

THE EAR, OR ORGAN OF HEARING.

This organ has been distinguished into three portions—the external, middle, and internal. A description of the external ear is not necessary in this work. From it a canal, the *meatus auditorius externus*, leads to the membrana tympani. This canal is about one inch and a quarter in length, is slightly convex in the centre, and is directed forwards; it is composed of cartilage, deficient anteriorly, and is lined by mucous membrane, covered by epithelium. In this is a number of sebaceous follicles, which secrete the wax of the ear. The *middle* ear, or *tympanum*, is a small circular cavity flattened at its sides. Externally it is bounded by the *membrana tympani*, which separates it from the meatus *externus*. This membrane is composed of three layers; an external one, continuous with the skin lining the meatus; an internal one, continuous with the mucous lining of the tympanum, and a middle, composed of elastic fibres. It is placed obliquely, so that its aspect is outwards, downwards, and forwards. The *malleus* is attached to its inner surface.

On the inner wall of the tympanum may be observed little projection called the *promontory;* above this a oval opening, closed by a membrane to which the se of the stapes is attached; this is the *fenestra alis*, and communicates with a part of the internal ; called the vestibule. Under the promontory is a all round hole (*fenestra rotunda*) communicating h the *scala tympani*, and closed by membrane.

n the posterior wall are seen the openings into the *toid cells*, below which is a hollow projection, the *mid*, containing the *stapedius* muscle; and below the *apertura chordæ* by which the chorda tympani comes from the Fallopian canal.

e floor of the *tympanum* displays the *glenoid e through which the processus gracilis* of the

malleus passes to give insertion to the musculus externus mallei or laxator tympani, and the chorda tympani also escapes.

The anterior wall displays one orifice, divided into two by the *processus cochleariformis;* the upper partition contains the tensor tympani, or internus mallei muscle; the lower is the tympanic extremity of the Eustachian tube.

The tympanum contains four bones (*ossicula auditus*) which stretch in an irregular chain from the membrana tympani to the fenestra ovalis. First, the *malleus*, which is attached to the membrana tympani; secondly, the *incus*, articulated with the malleus; and with thirdly, the *os orbiculare;* and fourthly, the *stapes* articulated on the one side to the os orbiculare, and on the other attached to the *membrana fenestræ ovalis.*

There are three muscles of the tympanum, which regulate the motions of the ossicles, and stretch or relax the membrana tympani, and membrana fenestræ ovalis.

The Eustachian tubes open from the tympanum into the upper part of the throat opposite the posterior extremity of the inferior spongy bone, and thus convey air into the cavity of the former, and allow the membrana tympani to vibrate freely. When these tubes are filled with mucus, or obstructed from disease of the throat, the hearing is always impeded.

The *internal* ear, or *labyrinth*, is subdivided into the vestibule, cochlea, and semicircular canals. The *vestibule* is the minute cavity contained between the fenestra ovalis, the cochlea, and the entrances to the semicircular canals. The vestibule is lined by a membranous expansion, which contains a peculiar fluid (*liquor Cotunnii*). The openings into the vestibule are—(1) the fenestra ovalis; (2) the opening into the cochlea; (3) the five openings of the semicircular [illegible]; (4) the aqueduct of the vestibule; (5) the [illegible] for the entry of the portio mollis.

The *cochlea* is a small osseous structure, which somewhat resembles the shell of a snail, from which similarity it receives its name. It consists of an osseous tube, twisted two and a half times round a central axis (*modiolus*). The summit is called the *cupola*. The *lamina spiralis* is a thin plate which winds round the axis, and thus divides the general cavity into two portions, denominated scalæ; one of these (*scala vestibuli*) communicates with the vestibule, the other (*scala tympani*) with the tympanum, by means of the fenestra rotunda.

The *semicircular* canals are three in number—two vertical and one horizontal; they open, as has been said, by five orifices into the vestibule, for the two vertical open by a common foramen, at one extremity; at their orifices are seen the *ampullæ*, or dilatations; corresponding with the terminations of the auditory nerve. The *portio mollis* of the seventh nerve supplies the ear, and is the true acoustic nerve; it is lost in a pulpy expansion resembling the retina. This nerve, having entered through the bottom of the meatus auditorius internus, is partly distributed to the vestibule and semicircular canals, and partly to the cochlea, in the form of loops and membranous expansions, which contain liquid and a certain quantity of calcareous granules.

PHYSIOLOGY OF HEARING.—Sound is produced by the vibrations of the air, caused by the contact of various agents. These vibrations are conducted by the *external ear* along the meatus auditorius to the membrana tympani, which is thrown into corresponding vibrations; these are communicated by the chain of small bones in the *middle* ear to the *internal*, where they impress themselves on the pulpy expansion of the retina, and are thus conveyed to the sensorium. The *Eustachian tube* permits of the passage of the air to and from the *middle ear, and thus* contributes to the *vibrations of the membrana tympani.*

ANATOMY OF THE VISCERA.

CAVITY OF THE CHEST.

Before entering on a description of the viscera contained in the cavity of the chest, I may briefly notice the larynx as forming a part of the respiratory apparatus.

The *larynx*, or *organ* of the *voice*, communicates above with the pharynx; inferiorly with the trachea. It is composed of five cartilages; the thyroid, cricoid, two arytenoid, and the epiglottis; it comprises also, ligaments, and numerous muscles, which open or close it, and regulate the tension of its various parts.

The *thyroid* cartilage, so called from its resemblance to an ancient shield, is composed of two broad plates, or *alæ*, which are united anteriorly, in the median line, at an angle so as to form a projection denominated the *Pomum Adami*. The upper edge of each *alæ* gives origin to a ligament which joins it to the os hyoides, and terminates in the *cornu;* the inferior edge is united by ligament to the cricoid cartilage, and also terminates in a species of cornu, which articulates with the side of the cricoid cartilage.

The *cricoid* cartilage forms a complete ring, and is situate between the above-mentioned cartilage and the upper part of trachea. It is narrow in front, and much deeper behind, where it is received between the alæ of the thyroid, and has the two arytenoids on its summit.

The *arytenoid* cartilages are placed, one on each side, on the superior edge of the cricoid cartilage; they are connected posteriorly by the arytenoid muscles, and give origin, anteriorly, to the *chordæ vocales*, which pass directly forwards, and are attached to the angle of the thyroid cartilage. The summit of each arytenoid is surmounted by a small cartilaginous *body, called the corniculum.*

The epiglottis is composed of elastic tissue, and rests

with its base on a ligament which passes between the tongue, os hyoides, and thyroid cartilage; it is also connected to the base of the tongue by a fold of mucous membrane, called *frenulum epiglottidis.*

The *cuneiform* cartilages are two small cartilaginous bodies which are found in the aryteno-epiglottidean ligaments.

The *ligaments* of the larynx, as described by anatomists, are very numerous; the principal are—1, the thyro-hyoid; 2, the crico-thyroid; 3, the thyro-arytenoid, or chordæ vocales; in addition to these there are the ligaments of the epiglottis, and those which attach the arytenoid cartilages and the inferior horns of the thyroid to the cricoid cartilage. The chief of these are the *chordæ vocales;* elastic chords stretching on either side from the base of each arytenoid cartilage, to the angle of the thyroid behind the pomum Adami. The aperture between them is called the *rima glottidis;* when this is open and relaxed it is triangular; when closed, also during speech, the chords are brought close to and parallel with each other. The anterior extremity of each chord is fixed; the posterior extremity, however, is attached to the arytenoid cartilage, which is moveable: and it is through the muscles attached to these cartilages that the chords are moved. Above each chorda vocalis is a semilunar fold of mucous membrane, and there is a deep cavity between the two, called sacculus laryngis.

The *glottis* is the name given to the upper aperture of the larynx. It is triangular; bounded before by the epiglottis, laterally by the *arytæno-epiglottidean ligaments,* which are two folds of mucous membrane, stretching between the points indicated by their names. When the larynx is raised by its muscles, and the tongue pushed back in the act of deglutition, this aperture is covered by the epiglottis, and so the food is prevented from entering the air passages. But a yet surer defence against intrusion is provided by the

muscles drawing the larynx upwards and forwards beneath the base or root of the tongue.

The principal muscles of the larynx are, the *crico-arytenoidei laterales* et *postici*, the *crico-thyroidei*, the *thyro-arytenoidei*, and the *arytenoideus*. The origins and attachments of the former muscles are pointed out by their names. Their uses are as follows :—the *arytenoideus* is formed of transverse and oblique fibres which connect the arytenoid cartilages. This muscle is remarkable for two circumstances—it crosses the median line of the body, and is lined on both sides by mucous membrane. Its obvious use is, to draw the arytenoid cartilages together, and close the *rima glottidis ;* that is, the aperture between the two chordæ vocales.

The *crico-thyroid muscles* are situated externally, and draw the thyroid cartilages forwards from the cricoid, and so tighten the chordæ vocales.

The *crico-arytenoidei laterales* and *postici* open the rima glottidis.

The *thyro-arytenoidei* runs under the mucous membrane along with the chordæ vocales, which they are supposed to slacken. But it is right to state that anatomists are still in uncertainty regarding the precise actions of these muscles.

The *glands* of the larynx are—1, the *epiglottidean*, placed in front of the epiglottis ; and 2, the *arytenoid* glands, in the aryteno-epiglottidean folds. The arteries of the larynx are derived from the external carotid and subclavian ; its nerves from the vagus. Vide p. 22.

The *trachea* is a cartilagino-membranous tube, which extends from the larynx to its division into bronchi, opposite the second or third dorsal vertebra. It is nearly of a cylindrical form, and is composed anteriorly of cartilaginous rings, united by fibrous elastic membrane, and posteriorly of muscle ; its diameter in the adult subject is about eight or ten lines. The *anterior surface of* the trachea is convex and covered *by the thyroid gland* and its veins, the sterno-hyoid

and sterno-thyroid muscles; and inferiorly is crossed by the innominata, arch of the aorta, and left brachio-cephalic vein. The *posterior* surface is flat, and rests on the œsophagus; on the *sides* are placed the common carotid arteries, the jugular veins, and pneumogastric nerves.

The division of the trachea into bronchi takes place near the level of the third dorsal vertebra. The *bronchi* are two in number; they are composed of incomplete cartilaginous rings, and pass nearly at a right angle into the substance of the lungs. The *right* bronchus is shorter, wider, and placed more horizontally, than the left one, passing under the azygos vein and the right branch of the pulmonary artery. The *left* bronchus is embraced by the aorta and left branch of the pulmonary artery. Each bronchial tube as it enters the lung divides into two branches, one for each pulmonary lobe; and on the right side the inferior branch sends off a third tube for the middle lobe of the lung. After a short course, the branches again subdivide; the subdivisions break up into smaller tubes, and this goes on in all directions, until each bronchus terminates in a small cul-de-sac, or air vesicle, the aggregate of which constitutes the cellular structure of the lungs. The cartilaginous rings of the bronchi gradually lay aside their annular form, appear as distinct points, and finally disappear altogether near the termination of the tubes.* The vessels of the trachea are derived from the superior and inferior thyroid arteries; its nerves from the vagus and cervical ganglia. The bronchial arteries are given off from the aorta, and the nerves which accompany the

* Reisseissen was the first who clearly pointed out their true nature; according to this anatomist, the smaller bronchi are composed of mucous membrane, cellular tissue, cartilaginous plates, and two orders of fibres, the one longitudinal, the other circular. The longitudinal fibres *he has* shown to be analogous to the elastic coat *of arteries; the circular* fibres he regards as *muscular, and capable of being affected* with spasm.

tubes are from the pulmonary plexus. The bronchial glands are situate near the bifurcation of the trachea, where they are numerous and variable in size; they also exist round the bronchi through the interior of the lungs.

The *thymus* gland is a fœtal organ, which occupies nearly the whole of the anterior mediastinum. It is composed of lobules, connected together and enclosed in a cellular capsule; it also contains a number of vesicles, and a reservoir, filled with a milky-looking fluid. Mr. Simon has ascertained that it serves as a kind of reservoir for the chyle, which is formed during digestion, till it is wanted for the purposes of the economy.

The *thyroid* gland, or body, is a structure, the uses of which are entirely unknown. It rests on the cartilaginous walls of the larynx and upper part of the trachea, and is covered by the sterno-hyoid, sterno-thyroid, and omohyoid muscles. The vessels of the thyroid body are derived from the carotid and subclavian arteries; its nerves from the vagus and sympathetic.

THORACIC VISCERA.

The *thorax* is a cavity of a somewhat conical form, bounded *anteriorly* by the sternum and cartilage of the ribs; *laterally*, by the ribs and intercostal muscles; *posteriorly*, by the ribs and vertebral column; and *inferiorly*, by the diaphragm. At its *superior* part, the thorax is closed by the pleuræ, and the following parts pass through it—viz., the sterno-hyoid and sterno-thyroid, and longi colli muscles; the innominata, left carotid, and left subclavian arteries; the venæ innominatæ; the pneumogastric, sympathetic, and phrenic nerves; the anterior branch of the first dorsal nerve; the trachea, œsophagus, and the thoracic duct. *Through the inferior* aperture of the thorax *pass the œsophagus*; aorta; vena cava, and azygos

vein; the vagus, splanchnic, and sympathetic nerves; the thoracic duct, and superficial absorbents of the liver.

The contents of the thorax are—the pleuræ, pericardium, heart and its vessels, the lungs, the parts embraced by the anterior and posterior mediastina, and the sympathetic nerves.

The *pleuræ* are two serious membranes, which line the interior of the thorax, and partially cover the lungs and other contents of that cavity. Each pleura lines its own portion of the thoracic parietes, and then is reflected over the convex surface of the diaphragm and pericardium, and over the vessels to the surface of the lung; dipping down, and lining the surfaces of the lobes also. Anteriorly and posteriorly along the median line, the two pleuræ are not in immediate contact with each other, but leave triangular spaces which are denominated the anterior and posterior mediastina.

The *anterior mediastinum* extends from the upper part of the sternum to the diaphragm, inclining a little to the left side. It contains the origins of the sterno-hyoid and sterno-thyroid muscles, the triangularis sterni, remnant of the thymus gland, the internal mammary vessels, some superficial absorbents of the liver, and some lymphatic glands, with cellular tissue in abundance.

The *posterior mediastinum* extends in front of the spine, from the third to the tenth dorsal vertebra. This space contains the œsophagus and aorta, the lower part of the trachea and origin of the bronchi, the pneumogastric and splanchnic nerves, the bronchial and œsophageal glands, the thoracic duct and vena azygos.

The two last-mentioned tubes are found on the right side of the thoracic aorta. The *thoracic duct* is the terminal vessel of the greater part of the absorbent system. It *commences in the abdomen*, on the second *or third lumbar vertebra, by a species* of dilatation

called the *receptaculum chyli;* it thence ascends through the aortic opening of the diaphragm, between the vena azygos and aorta, turns behind the arch of the aorta, and passing behind the œsophagus, lies between its left side and the pleura. Continuing its course, it ascends into the neck, lying on the longus colli muscle, until it arrives at the level of the upper border of the seventh cervical vertebra; whence it winds forwards and downwards, and enters the left subclavian vein at its junction with the jugular. At the mouth of this duct are two valves, which allow of the free egress of the chyle, but effectually prevent any ingress of blood.

The *vena azygos* begins by the branches of the lumbar veins, which it receives; then passes from the abdomen into the thorax through the aortic opening of the diaphragm, or sometimes through the fibres of the muscle, and ascends on the bodies of the dorsal vertebræ, until it arrives opposite the root of the right lung; here it arches forward above the bronchus, and opens into the superior vena cava, just above the point where that vessel is invested by the pericardium. In its course it receives lumbar, œsophageal, intercostal, pericardial, and mediastinal veins; also the vena azygos minor and the *right bronchial* vein. The *left bronchial* vein opens into the left superior intercostal vein.

The *vena azygos minor* commences, from one of the lumbar veins, or from the left renal vein; and having entered the thorax through the aortic opening, or through the crus of the diaphragm, ascends on the spine, receives the inferior intercostal veins of the left side, crosses behind the œsophagus and aorta, and opens into the vena azygos, opposite the sixth or seventh dorsal vertebra.

The *lungs* are two cellular, elastic organs, of a conical figure, contained within the cavity of the chest, and *separated from each* other by the heart and mediastina. *They are, however,* connected at their roots by the

bifurcation of the trachea, and are, moreover, attached to the heart by the pulmonary vessels. The base of each lung is concave, and rests upon the diaphragm; the apex forms an obtuse, rounded point, which ascends a little above the level of the first rib. The external surface convex; the internal, where the vessels enter, concave; the posterior border rounded and fitting into the space between the vertebræ and ribs:—the anterior sharp, and overlapping the pericardium.

At the *root of the lungs*, or place where the vessels enter, the order of parts is from above downwards, in the *right* lung, bronchial tube, pulmonary artery, pulmonary veins; in the *left* lung, pulmonary artery, bronchial tubes, pulmonary veins. The order from before backwards is the same in both—viz., veins, arteries, bronchial tubes. The bronchial arteries and veins, and the pulmonary nerves and absorbents are chiefly behind.

The surface of the lung, which appears polished, from being covered with serous membrane (*pleura pulmonalis*), is everywhere in contact with the parietes of the thorax, and presents a colour, which varies according to the age; being pink in the young, grey in the adult, and nearly black in the aged, from a deposit of carbonaceous matter. The specific gravity of the lung is much affected by the act of respiration: thus the lungs of a child who has respired will be found to be nearly twice as heavy, in proportion to the whole body, as those of a child who has not breathed. Because in the act of breathing, the blood is allowed to rush for first time into the lungs through the pulmonary arteries. The right lung is divided into three lobes by two fissures; the left lung is separated by one fissure only, and consequently has but two lobes. The bronchial tubes having divided to extreme minuteness, end each in a number of air-cells, which are collected into one lobule; and the lobules are seen by inspecting the surface of the lung to be pentagonal in figure.

On the membrane lining the air-cells, the pulmonar artery ramifies; the blood in it when aerated bein returned by the pulmonary veins. The bronchi arteries and veins nourish the substance of the lung as the hepatic artery does that of the liver. The *nerv* of the lungs are divided from the anterior and posteric pulmonary plexus of the pneumogastric. Their nu trient *arteries*, denominated bronchial, arise from th aorta. A great number of *lymphatics* pass from th pulmonary tissue to the bronchial glands, which su round the bronchi and trachea at the root of th lungs. These glands are often filled with carbonaceou or calcareous deposits in old age. According t Laennec, the *right* lung is more frequently the seat c tubercle than the left, and the upper portion of th former is the point in which the tubercular matter most frequently developed; hence, when suspicion c consumption exists, the upper part of the right lun should always be most carefully examined. This doe not agree with the observations made in this country as the apex of the left lung appears to be more fre quently affected with tubercles.

PHYSIOLOGY OF RESPIRATION.—The atmospheric a being exposed on the surface of the air-cells to th venous blood in the pulmonary veins, changes th blood into arterial by means of its *oxygen*, whicl uniting with the carbon of the venous blood, form carbonic acid, which is expelled during respiration. Eigh parts of oxygen disappear at each act of inspiration, an eight parts of carbonic acid are found in the expire air; the nitrogen is chiefly useful in diluting the oxygen Atmospheric air consists of nitrogen or azote, seventy nine; oxygen, twenty; carbonic acid, one.—Som physiologists contend that the oxygen is only absorbe in the lungs, and that its union with the carbon take place in the capillary vessels.

HEART.

The heart is enclosed in a fibro-serous membrane called the *pericardium*, which is lodged in the middle mediastinum, and attached to the central tendon of the diaphragm. The outer, or *fibrous* layer of the pericardium ascends from the aponeurosis just mentioned, embraces the heart on all sides, and is then gradually lost on the great vessels. The inferior cava is the only one which does not possess a fibrous sheath derived from the pericardium. The *serous* membrane lines the inside of the fibrous layer, and is reflected back on the great vessels of the heart, to cover the external surface of this latter organ. The inner surface of the serous membrane is constantly moistened by a serous fluid. The *arteries* of the pericardium are derived from the aorta, the coronary, the internal mammary, the bronchial, thymic, phrenic, and œsophageal arteries. Its veins terminate chiefly in the vena azygos; the lymphatics proceed to the glands situated behind the aorta. Anatomists have not described any nerves peculiar to this membrane.

The *heart** is a hollow muscle of pyramidal form,

* *Of the Circulation of the Blood.*—The heart is that part of the vascular system which is the principal propelling power of the blood. The heart of a man in the middle period of life contracts seventy to seventy-five times in a minute; the frequency of its action gradually diminishes from the commencement to the end of life in the annexed ratio:—

In the embryo, the number of beats in a minute is ...		150
Just after birth	from 130 to	140
During the first year	— 115 —	130
——— ——— second year.....	— 100 —	115
During the third year.....	— 90 —	100
About the seventh year	— 85 —	90
——— ——— fourteenth year	— 80 —	85
In the middle period of life	— 70 —	75
In old age	— 50 —	65

In persons of a sanguine temperament the heart beats somewhat

placed obliquely between the lungs. It is distinguished into an apex, body, and base.

The *base* of the heart is situated above, and a little to the right side; the *apex*, which points obliquely to the left, is received into a depression in the lung, at the interval between the cartilages of the fifth and sixth ribs. The *anterior* surface of the heart is marked by a groove which receives the anterior coronary artery and vein. The *posterior* surface, which is almost horizontal in the natural state, is likewise marked by a groove for the posterior coronary vessels. The *right* margin of the heart is inferior, and rests for the most part on the diaphragm; the *left* margin looks upwards and backwards. The heart is composed of four cavities, denominated auricles and ventricles. The two auricles occupy the base, one on each side; the two ventricles compose its body and apex.

The *right auricle* is placed at the right side of the base of the heart, and rests upon the diaphragm. It is of a very irregular shape, and is distinguished into the proper auricle and appendix. It is larger than the corresponding organ of the opposite side. On opening the right auricle we discover the following parts:—Above and posteriorly, the opening of the *superior cava;* immediately below, the orifice of the *inferior cava;* and between them, a prominence called the

more frequently than in those of a phlegmatic; and in the female sex more frequently than in the male.

The blood is returned from all parts of the body by the two venæ cavæ, and from the structure of the heart itself by the coronary veins and foramina Thebesii into the right auricle; at the same time, the blood is returned from the lungs by the four pulmonary veins into the left auricle. The two auricles contract *synchronously*, and propel their contents into their respective ventricles; the ventricles now contract, and the auriculo-ventricular openings being closed by their proper valves, the blood is propelled at the same moment from the right ventricle into the pulmonary *artery*, and from the left into the aorta. The blood, once in those *arteries, cannot return* when the ventricles become relaxed, *because the column of* blood in the arteries themselves spreads out *the semi-lunar valves* at their orifices, and closes them.

tubercle of Lower. The opening of the inferior vena cava is partially masked by the *Eustachian valve*, a fold of membrane placed between that opening and the inner border of the *annulus ovalis*. This in the adult is a mere rudiment; but in the fœtus it was a complete *foramen*, through which the blood passed into the left auricle. Under the Eustachian valve we find the common orifice of the coronary veins, protected by a valve.

The *inner* wall of the auricle presents a thick septum (*septum auriculorum*), in the middle of which we observe a depression (*fossa ovalis*,) which, in the fœtus, was occupied by the *foramen ovale*. This sometimes remains open for a considerable time after birth, and gives rise, though not constantly, to the disease called cyanosis. In different parts of the auricle we also observe a number of small orifices (*foramina Thebesii*), supposed to be openings of veins. The *musculi pectinati* are a number of fleshy fibres, arranged in parallel columns, and situated chiefly in the appendix of the auricle. Inferiorly, the right auricle communicates by a wide circular opening with the right ventricle.

The *right ventricle* forms the greater portion of the anterior surface of the heart. The parts observable in it are the muscular bundles (*carneæ columnæ*) and their tendons (*chordæ tendineæ*); the tricuspid valves; the opening of the right auricle, and that of the pulmonary artery. The *carneæ columnæ* are rounded fleshy fasciculi, which are divisible into *three* orders: *first*, the most numerous set are attached in their whole extent to the walls of the ventricle; the *second*, are next in number, and are adherent to the walls by both extremities, and free in the rest of their extent; the *third* vary from three or four to eight or nine in number. These all arise from some point of the walls of the ventricle, direct themselves, becoming larger, from its summit towards its base, and terminate abruptly, each by several small tendons (*chordæ tendineæ*) which are

inserted into the margins of the tricuspid valve, and passing from their under surface into the zona annularis.

The *tricuspid valve* is a membranous fold, adhering by one edge to the circumference of the auriculo-ventricular opening, and with the other giving attachment to the chordæ tendineæ. The opening of the pulmonary artery is placed at the upper and left part of the right ventricle; it is furnished with three membranous folds (*semilunar* or *sigmoid valves*), the concavities of which look towards the artery, and at the centre of each fold at the free edge is placed a small tubercle (*corpus Aurantii*), which is said to aid still further in closing the artery. Between the semilunar valves and the wall of the artery are three pouches, called the *pulmonary* sinuses; there are three similar depressions in the aorta, at the valves which guard its opening.

The *left auricle* is situated at the left and posterior part of the base of the heart; its capacity is about one-fifth less than that of the right auricle. This auricle also presents an appendix; in its posterior wall we find the openings of the two right pulmonary veins: in its left, those of the corresponding pulmonary veins; the right wall of the auricle is formed by the inter-auricular septum. The auriculo-ventricular opening joins, as its name imports, the auricle to the ventricle.

The *left ventricle* is narrower, but longer than the right. Its capacity is smaller, and its walls much thicker. Its internal structure is exactly the same, and it presents the same number of openings. The left auriculo-ventricular opening is guarded by the *mitral valve*, so called because its free edge is divided into two pointed portions, to which the chordæ tendineæ are attached. The opening of the aorta, like that of the pulmonary artery, is guarded by three *semilunar* valves, outside which we find dilatations, called the *aortic sinuses* (or *sinuses* of *Morgagni*). The free *edges of these* valves also contain corpora Aurantii,

and behind them we find the two orifices of the coronary arteries. It is difficult to give to the student an idea of the complicated structure of the human heart. M. Cruveilhier describes it as being composed of two muscular sacs, contained in a third one, common to both ventricles. The internal surfaces or cavities of the heart are lined throughout by a serous membrane, the *endocardium*. The arteries of the heart are the two *coronary*, which arise behind the semilunar valves of the aorta, and run along the anterior and posterior median grooves.

The coronary veins open by a common orifice into the right auricle. The cardiac nerves are derived from the eighth pair and the sympathetic; the lymphatics are numerous, and pass to the glands in front of the aorta. The size of the healthy heart in the adult varies much; Laennec says, that it should be about the size of the fist of the individual. Its weight is about seven to eight ounces; but when hypertrophied, it will weigh as much as twenty ounces, or even more.

The great vessels which arise from the heart are, the aorta and pulmonary artery; the veins which empty themselves into it are, the two venæ cavæ, the four pulmonary, and the coronary veins. The *aorta* ascends from the left ventricle of the heart, being covered by the pulmonary artery, obliquely, fowards and to the right side, until it reaches the level of the upper edge of the second costal cartilage, when it proceeds transversely from right to left, forming what is called the arch of the aorta; the great vessel now curves downwards, and runs along the bodies of the dorsal vertebræ a little to the left side. The arch of the aorta is divided into ascending, transverse, and descending portions. The *ascending* portion is chiefly contained in the pericardium; in it are *found the* orifices of the coronary *arteries and the sinuses of Morgagni*. The *transverse portion lies in front of* the trachea, and

gives origin to the great vessels of the head, neck, and upper extremities. The *descending* portion passes downwards and backwards, between the spine and left lung, and ends at the left side of the body of the third or fourth dorsal vertebra. The *œsophagus* and *thoracic duct* lie on the right side, the former somewhat in front of this portion of the arch.

The *pulmonary artery* arises from the right ventricle, and passes upwards and to the left over the ascending portion of the arch of the aorta, and divides at the level of the second dorsal vertebra into the right and left pulmonary arteries. The former, which is longer and larger than the left, passes under the aorta and superior cava to the right lung. The left pulmonary artery passes obliquely in front of the aorta to the corresponding lung. From the point of division of the pulmonary artery, a rounded short chord passes to the aorta. This is the remnant of the *ductus arteriosus*, by which the blood in the fœtus was conveyed directly from the pulmonary artery to the aorta, instead of passing into the lungs.

The *pulmonary veins* arise from the pulmonary capillaries. They form successively larger veins, which are finally assembled into *four* trunks, emptying themselves, as has been already said, by four orifices into the left auricle. Both the aorta and pulmonary arteries are connected to the muscular tissue of the heart through the medium of two fibrous circles of a peculiar nature, from which fibres pass to the sigmoid valves, and to the angles of the festoons which these vessels present at their origin.

The aorta gives origin to the arteries of the human body. The following description of them is merely intended as a summary to aid the student's memory:—

The aorta is commonly distinguished into an arch, *thoracic* aorta, and abdominal aorta.

Arch of the aorta. There arise from this portion *five vessels: the* right and left coronary arteries, to

ance of the heart; the *innominata;* the *left* the *left subclavian.* These supply with blood , neck, and upper extremities.
teria innominata, after a short course, divides *right subclavian* and *right common carotid.*
mmon carotid divides opposite the hyoid bone, *external carotid* and the *internal carotid.*
xternal carotid gives off nine principal :—
e *superior thyroid,* whose branches are, ramus , ramus superficialis, ramus laryngeus, ramus us.
e *arteria lingualis.* Its branches are, ramus , dorsalis linguæ, sublingualis, ranina.
e *facial,* or *external maxillary artery,* whose are—1, the inferior palatine; 2 tonsilitic; dular branches; 4, submental; 5, inferior 6, inferior coronary; 7, masseteric branches; ior coronary; 9, lateral nasal; 10, angular.
teria muscularis, or *sterno-mastoid.*
cipital artery, supplies many of the deep on the upper and back part of the neck, the id the back of the ear.
e *ascending pharyngeal.*
e *transversalis faciei.*
e *internal maxillary,* whose branches are very is:—Middle meningeal, inferior dental, ptery- nches, deep temporal, masseteric, buccal, su- ental, infra-orbital, descending palatine, nasal.*
e *superficial temporal,* or terminating branch external carotid. Its branches are, the ante- uris, capsulares, temporalis media, posterior l, anterior temporal.
nternal carotid is the larger division of the carotid in the young person, but the smaller

artery gives branches *which accompany* almost every the *2nd and 3rd divisions of the* fifth, and of Meckel's

in the adult. It is chiefly distributed to the brain passing into the cranium through the carotid canal o the temporal bone. It gives off a few small branche in the canal, and in the cavernous sinus, and fur nishes—

1. The *arteria ophthalmica.* This enters the orbi by the optic foramen, and sends off the following branches :—Lachrymalis ; centralis retinæ ; supra or bitalis ; ciliares ; musculares ; ethmoidales ; palpebralis superior and inferior ; nasalis ; frontalis.

2. *Arteria communicans Willisii.* This arises from the internal carotid in the interior of the cranium, and communicates with the posterior cerebral artery, a branch of the basilar.

3. The *anterior cerebral artery.* This, after furnishing numerous small twigs, approaches the corresponding artery of the other side, to which it is joined by,

4. The *anterior communicating artery.* This anastomosis constitutes the anterior portion of the *arterial circle of Willis*, by which a free circulation is maintained at the base of the brain. The anterior cerebral arteries terminate in those of the corpus callosum.

5. The *middle cerebral artery* is a large branch, following the course of the fissure of Sylvius, and is bedded in it.

The *subclavian arteries* differ from each other some particulars. The right subclavian is a branch the innominata ; the left springs from the aorta. They are divided into the following portions :—the *subclavian*, properly so called ; the *axillary ;* and the *brachial.* The *subclavian portion* of the artery gives five branches :—

1. *Arteria vertebralis.* This gives off, arteriæ spinalis, anterior and posterior ; arter. cerebri inferior or posterior ; and, ultimately uniting with the *opposite vertebral*, forms the basilar artery. The basilar *gives rise to* the arter. cerebri posteriores,

anastomose with the arter. communic. Willisii; and the arter. cerebelli anterior.

2. *Mammaria interna.* Its branches are, art. intercostales anteriores, art. mediastini, comes nervi phrenici, musculo-phrenica, abdominales.

3. *Axis thyroideus.* Its branches are, inferior thyroid, cervicalis ascendens, supra scapular or transversalis humeri, posterior scapular or transversalis colli.

4. *Cervicalis profunda.*

5. *Intercostalis superior.*

The artery having reached the lower border of the first rib, receives the name of

The *axillary.* Its branches are, thoracica acromialis, thoracica suprema, thoracica alaris, thoracica longa, subscapularis, internal circumflex, external circumflex. Below the lower margin of the teres major it is called the

Brachial or *humeral.* This gives off the art. profunda superior, profunda inferior, anastomotica magna. Below the bend of the elbow, the humeral artery subdivides into two large branches, the *radial* and *ulnar.*

The *ulnar* gives off seven branches—the anterior and posterior recurrents, the interosseal, the anterior and posterior carpal arteries, ramus communicans (which joins the deep palmar arch), and the superficial palmar arch, from which arise the digital arteries.

The *radial artery* is smaller than the ulnar. Besides numerous muscular branches, it gives off eight principal ones:—Radialis recurrens, superficialis volæ, anterior and posterior carpal arteries, dorsal arteries of the thumb, arteria magna pollicis, radialis indicis, palmaris profunda.

The *thoracic aorta* is the second division of the great trunk of the aorta; the following branches arise from it:—

Art. bronchiales.

Œsophageæ.

Intercostales.

The *abdominal division* is the last portion of the aorta. It furnishes,

The *right* and *left phrenic.*

The *cœliac axis,* from which arise, art. gastrica or coronaria ventriculi, arteria herpatica, arteria splenica.

1. *Arteria coronaria ventriculi.* Its branches are, art. œsophageæ, art. gastricæ.

2. *Arteria hepatica.* The branches of this artery are, the pylorica superior, gastro-duodenalis (which gives off, pancreatico-duodenalis, pyloricæ inferiores, and gastro-epiploica dextra); the continuation of the hepatic artery divides into art. hepaticæ dextra et sinistra, and ramusculus cysticus.

3. *Arteria splenica* gives off pancreaticæ parvæ, pancreatica magna, vasa brevia, art. splenicæ, gastro-epiploica sinistra.

The *arteria mesenterica superior.* The branches of this artery are, the large branches supplying the jejunum and ileum, the arteria ilio-colica, the colica dextra, the colica media.

The *inferior mesenteric artery* gives off, the colica sinistra, art. sigmoidea, art. hæmorrhoidalis. From the sides of the aorta are given off—

Arteriæ capsulares.

Renales.

Lumbales.

Arteriæ spermaticæ, from the anterior part of the aorta.

Sacra media. This is the terminating branch of the aorta.

The *arteria iliacæ communes.* These result from the bifurcation of the aorta, and soon subdivide into external and internal iliacs.

The arteria iliaca externa extends to the crural arch, *assumes the* name of femoral, and chiefly supplies the *lower extremity.* Before passing under the crural

, it furnishes two branches—the internal epigas-
and the arter. circumflexa ilii.

he *common femoral artery*, after a course of two
hree inches, subdivides into superficial and deep
oral (*profunda femoris*). In its course it gives off,
epigastrica superficialis, circumflexa ilii superfici-
pudica externa.

he *superficial femoral artery* seems to be the con-
ation of the common trunk; it descends along the
h into the popliteal space, and after traversing it,
des at the inferior margin of the popliteus muscle
two branches—viz., the posterior tibial and an-
or tibial. The superficial femoral supplies several
scular branches, the anastomotica magna, and
omes

he *popliteal artery*, which gives off the internal
erior articular artery, the external superior articu-
the middle articular, arter. surales, the internal
rior articular, external inferior articular. The ves-
then divides into the anterior tibial and the posterior
al.

he *arteria profunda femoris* gives off, arteria
umflexa externa, circumflexa interna, perforans
ma, perforans secunda, perforans tertia.

he *posterior tibial artery*, the largest division of
popliteal, gives off a few muscular branches, but
n subdivides into the fibular or peronæal, and the
per posterial tibial.

he *fibular* soon after subdivides into many muscu-
branches.

he *posterior tibial*, besides giving numerous mus-
ar branches to the deep flexors of the toes, sub-
ides into the internal plantar and external plantar;
latter gives off the digital branches, and anasto-
ses freely with the anterior tibial.

he *anterior tibial artery* passes through an opening
the interosseal *ligament, and thus* gains the anterior
ect of the leg. In its course it sends off, the re-

currens, many muscular branches, internal malleolar, external malleolar, arteria tarsi, arteria metatarsi, ramus communicans. arteria pollicis.

The *internal iliac* or *hypogastric artery*, results from the bifurcation of the common iliac. Its branches are, the ilio-lumbalis, sacri lateralis, hæmorrhoidalis media, arteriæ vesicales, umbilicales (obliterated after birth), uterina, vaginalis, obturatoria, gluteal, ischiatica, and arter. pudica interna. The branches of the internal pudic are, the external hæmorrhoidal, artery of the perinæum, the transversalis perinæi, arter. corporis bulbosi, arter. corporis cavernosi penis, arteria dorsalis penis.

THE VEINS.

The most natural order in which the veins can be described is, to follow them from the extreme parts of the body towards the heart. As, however, the right auricle receives two venous trunks (the superior and inferior cava), it becomes necessary to describe, separately, the branches which coalesce to form these. First, *of the veins which ultimately form the inferior vena cava*—

The *internal vena saphena* commences on the great toe, extends over the dorsum of the foot, and ascends over the malleolus internus and ankle joint, to the inner part of the leg, and passes behind the inner condyle of the femur. It then ascends on the inner side of the thigh, and passing through the saphenic opening in the fascia lata, joins the femoral vein.

The *external vena saphena* commences on the outer side of the foot, and having communicated by a large branch with the internal saphena, ascends on the back of the leg, and terminates in the popliteal vein.

The *popliteal vein* is situated first at the outer, and afterwards at the posterior part of the popliteal artery, *and is formed by the* union of the deep veins in addition *to the external* saphena. These deep veins accom-

pany the anterior tibial, posterior tibial, and peroneal arteries (two veins with each artery). The popliteal ascends along the inner part of the thigh close to the artery, then becomes femoral, and reaches the crural arch, through which it passes, placed on the inner side of the artery. As soon as the femoral vein has passed under the crural arch, it assumes the name of *external iliac*, and its branches and course are precisely similar to those of the iliac artery.

The *internal iliac*, or *hypogastric vein*, is placed rather behind the internal iliac artery, and is formed of branches which correspond to the divisions of that artery.

The *external and internal iliac veins* unite on their respective sides of the body, opposite the sacro-iliac articulations, and thus give rise to the *common* iliac veins; these veins ascend obliquely inwards towards the inter-articular cartilage between the fourth and fifth lumbar vertebræ, where they unite and form one great trunk.

The *vena cava inferior*. This vein ascends along the front of the bodies of the vertebræ, on the right side of the aorta, then passes through a groove in the posterior border of the liver, traverses the central tendon of the diaphragm, and almost immediately terminates in the lower part of the right auricle of the heart. In this course the inferior cava receives the middle sacral, lumbar, right spermatic, capsular, renal, inferior phrenic, and hepatic veins.

VENA PORTÆ.—This vessel conveys to the liver the blood from all the chylopoietic viscera, but not from the limbs, kidneys, or organs of generation. The veins from the different viscera unite into two principal trunks—viz., the splenic and superior mesenteric; by the union of which the *vena portæ* is formed.

Splenic vein.—This vein arises from the spleen by a number of branches *varying from three* or four to seven or *eight, which, after a short course,* unite upon the

pancreas into a single trunk. It then directs itself transversely from left to right, beneath the splenic artery, and behind the pancreas, to unite with the superior mesenteric vein, opposite the vertebral column. In its course it receives the veins corresponding to the *vasa brevia;* the right and left *gastro-epiploic veins*, the *duodenal* and *pancreatic veins*, the *coronary vein of the stomach*, and *the inferior mesenteric vein.*

Inferior mesenteric vein.—The roots of this vein correspond to the ramifications of the artery of the same name. They commence behind and at the sides of the rectum, from which they ascend, and unite to form a single vessel, towards the sigmoid flexure of the colon. From this point it ascends vertically behind the peritoneum of the left lumbar region, and joins the superior mesenteric vein.

The *superior mesenteric vein.*—This vein corresponds with the artery of the same name, to the right and a little anterior of which it is placed. It is formed by all the veins of the small intestines, and by the veins corresponding to the ilio-colic, right colic, and middle colic arteries. The trunk formed by the union of these branches inclines upwards and to the right side, enters beneath the pancreas, and unites with the splenic vein nearly at a right angle, after receiving several duodenal and pancreatic veins.

The trunk of the vena portæ results from the junction of the superior mesenteric and splenic veins; but its diameter is much smaller than the sum of the diameter of these two veins. This vein ascends obliquely to the right, and has about four inches of extent from the vertebral column, where it commences, to the groove of the liver, where it terminates. In the gastro-hepatic omentum it lies behind, and in a manner between the hepatic artery and ducts; it is also surrounded by filaments of the hepatic plexus of *nerves, and by lymphatics.* When near to the right *extremity of the* transverse fissure, the vena portæ

divides into two branches; the *right*, shorter, but larger than the left, enters the right lobe of the liver, and ramifies to infinity in its structure; the *left*, which is smaller and longer, proceeds horizontally as far as the ligament of the umbilical vein, sends a branch to the lobulus Spigelii, and enters the left lobe. All the branches of the vena portæ are surrounded in the liver by prolongations of the fibrous structure (*capsule of Glisson*) of that organ.

SUPERIOR CAVA.—*The veins which compose the superior vena cava are the following:—*

The *cephalic vein* commences by a number of branches on the back of the hand; many unite upon the thumb into one trunk, which takes the name of the cephalic vein of the thumb; this trunk and the other branches from the back of the hand ascend, and reach the anterior and external part of the fore-arm, where they form the *superficial radial vein*. At the bend of the arm, the trunk is of considerable size, and receiving the *median cephalic*, assumes the name of the *cephalic vein*, ascends along the external edge of the biceps to the space between the great pectoral muscle and deltoid, and having passed under the clavicle, joins the axillary vein.

The *basilic vein* is formed by the *posterior* and *anterior ulnar*. The posterior ulnar commences on the inner part of the back of the hand from a great number of minute branches, forming generally a pretty large trunk on the inner part of the hand, called the *vena salvatella*. This vein ascends upon the inner part of the fore-arm, and assumes the name of the posterior ulnar; it turns forwards somewhat below the bend of the elbow, and unites with the anterior ulnar vein. The *anterior ulnar vein* ascends on the anterior aspect of the fore-arm, communicating with the median vein externally, and the posterior ulnar vein internally. A *little below the bend of* the elbow it unites *with the posterior ulnar cutaneous* vein, and, assuming

the name of *basilic vein*, and receiving a branch of the median vein, called the *median basilic*, ascends along the inner part of the arm, and terminates in one of the venæ comites of the brachial artery, or in the axillary vein.*

The *median vein* is formed by a collection of numerous branches on the anterior part of the fore-arm, and near the bend of the elbow terminates in three branches, one to the cephalic, the other to the basilic, under the names of *median cephalic* and *median basilic veins;* the *third* branch joins one of the venæ comites of the brachial artery.

The arteries supplying the arm and hand with blood have accompanying veins, generally two in number, which unite until they are diminished to two, which embrace the brachial artery; the basilic also joins them, and they thus form,

The *axillary vein*, situated anterior to the axillary artery, and receiving the circumflex, sub-scapular, alar, long thoracic, superior thoracic, acromial, and cephalic veins. After passing under the clavicle, the vein changes its name to subclavian, and receiving the internal jugular vein, becomes

The *vena innominata*. The right vena innominata is short; the left vena innominata is longer and larger than the right; it receives analogous veins to the right, and in addition the *left internal mammary* and *left inferior thyroid*. The venæ innominatæ also receive the superior intercostal veins.

The subclavian veins, before they become innominatæ, are joined by the external and internal jugular veins. The *external jugular* vein is formed by the union of the veins accompanying the internal maxillary, superficial temporal, and posterior auricular arteries; it descends along the side of the neck, under the *platysma-myoides*, and joins the subclavian exter-

* *The cephalic corresponds to the internal saphena, and the basilic vein to the external saphena of the leg.*

nally to the internal jugular vein. In this course it receives the cervical cutaneous, some scapular, and other venous branches. The *internal jugular* vein, having received the blood from the brain, eye, part of the nasal fossæ, &c., through the lateral sinus, and also from the facial, lingual, occipital, pharyngeal, superior and middle thyroid veins, descends along the outer side of the common carotid artery to join the subclavian vein, and form the innominata. The right and left venæ innominatæ unite, opposite the cartilage of the first rib, on the *right* side, just above the arch of the aorta, and form the superior vena cava, which descends a short distance, and then enters the right auricle of the heart. Before it penetrates the pericardium, the superior cava receives the vena azygos, and the *right* internal mammary, inferior thyroid, pericardiac, and superior phrenic veins.

The veins which have no valves are—the encephalic, those of the spine and diploe, those of the lungs, the vena portæ, the umbilical vein, the venæ cavæ, unless at the mouth of the vena azygos, the uterine veins, and the median vein.

THE LYMPHATICS.

The lymphatic vessels are delicate tubes, presenting, when full, at short intervals, dilatations which give them a knotted appearance, owing to the presence of valves in the interior of the tube, whose arrangement and function is altogether very similar to those of veins. At certain points, especially near the flexure of joints, the lymphatic vessels pass through the *lymphatic glands*, small rounded bodies formed of convoluted lymphatic vessels. These vessels are arranged in the body at two distinct planes, a *superficial* and a *deep-seated*. The *superficial* form a net-work in the subcutaneous cellular tissue, and are distributed in a very uniform manner. The *deep-seated* unite into bundles

around the blood-vessels, whose direction they follow; the two planes communicate frequently by numerous twigs, and unite to form plexuses. The lymphatics of both the inferior extremities, the abdomen, left side of the thorax, left superior extremity, left side of the head and neck, terminate in one principal trunk, situated on the front of the two superior lumbar, and nearly all the dorsal vertebræ, and termed the *thoracic duct;* the lymphatics from the right side of the head and neck, right upper extremity, and right side of the thorax, form a short trunk situated on the right side of the upper dorsal vertebræ.

The *lymphatic vessels of the inferior extremities* are divided into superficial and deep. The superficial follow chiefly the course of the saphena veins; the deep, those of the great blood vessels. The lymphatics of the hips join the superficial inguinal glands; likewise those of the loins, the lower half of the walls of the abdomen, the lymphatics of the perinæum, scrotum, and penis. In the female the lymphatics of the labia pudendi and clitoris have the same termination. The deep obturator, ischiatic, genital, &c., lymphatic vessels arise near and accompany the respective arteries, all terminating either in the hypogastric or lumbar glands.

The lymphatics of the uterus unite with those coming from the vagina, to terminate in the hypogastric glands. Others, again, unite with those of the ovaria. The lymphatics from the bladder, kidneys, and supra-renal capsules, communicate with the hypogastric, lumbar, or splenic glands, and follow the course of the respective arteries distributed to these organs.

The lymphatic vessels of the abdominal and pelvic parietes generally accompany the arteries, and form *the external iliac lymphatic plexus*, the *hypogastric lymphatic plexus* placed on the sides of the sacrum, *and the lumbar lymphatic plexus*.

ıe whole surface of the mucous membrane of
tinal canal. The lacteals enter the mesentery,
course of the vessels, and after anastomosing
ıing each other several times, gain the mesen-
meso-colic glands; as they proceed they gra-
ıite, two or three converging to form one;
y become diminished in number, until finally,
the roof of the mesenteric artery, two or three
re formed, which open into the *receptaculum*
ometimes, however, six or seven of these ves-
into the commencement of the thoracic duct.
ials of the small intestines, the cæcum, and
ding and transverse colon, terminate as above
l; those from the descending colon and its
flexure join some of the lumbar lymphatics.
ıphatics of the stomach, great omentum,
ıancreas, and liver, all ultimately join the
duct directly or indirectly.

ıoracic duct (*ductus thoracicus sinister*) com-
ın the body of the third lumbar vertebra, by
n of five or six trunks, resulting from the

The lymphatics of the *superior extremities* resemble in their general course and disposition those of the *inferior extremities*, being superficial and deep, &c. A considerable number of lymphatic glands are collected in the axilla, and one or two are generally found in front of the internal condyle of the humerus. The cranial lymphatics, those of the face, and the superficial anterior lymphatics of the neck, chiefly open in the left side into the highest part of the thoracic duct, and on the right side into the great lymphatic vessel of that side.

PHYSIOLOGY OF THE CIRCULATION.—The venous blood is received from the two venæ cavæ into the right auricle of the heart, whence it pours into the right ventricle, which propels it along the pulmonary arteries into the lungs; from these the blood (now arterial or red) is carried by the pulmonary veins into the left auricle, from which it pours into the left ventricle, which propels it into the aorta, and thus over the arterial system; from this it is received by the veins and is conveyed (now venous or black) by the venæ cavæ back to the right auricle.

The chief agents in the circulation of the blood are the ventricles of the heart, the right effecting *the pulmonic circulation*, the left the *systemic;* these they effect by their powerful contraction on the blood in their cavities.

The use of the arteries is to convey the blood, and by their elasticity—1. To regulate the violent action of the ventricles. 2. To react upon the blood during their contraction. 3. To keep constant by these means the flow of blood. The action of the arteries alternates with that of the ventricles. The systole or contraction of the one corresponding to the diastole or dilatation of the other, the arteries and auricles, the *ventricles* and veins, act simultaneously.

The arteries are supposed by many to present *independent muscular* contractility; but this is not gene-

lly acknowledged. Muscular fibres cannot be demonrated in them. The prevailing opinion is, that the pillary arteries possess independent contractility though not muscular fibres.

The *venous circulation* is carried on, 1. By the s a tergo from the capillary arteries. 2. By the ntraction of the adjacent muscles, which owing to e presence of the valves must propel the blood onrds to the heart. 3. By gravitation in some parts. By the muscular action of the inferior cava. 5. By e influence of the vacual tendency in the right auricle. As the *vena portæ* possesses no valves, its circulation chiefly carried on by the vis a tergo and by the cual tendency in the liver; its circulation is languid, nce its frequent congestion.

The *lymphatic circulation* is produced chiefly by the tion of the surrounding structures, as in the veins.

Two arteries, the pulmonary and umbilical, convey nous blood; and two veins, the pulmonary and umbil, convey arterial blood; one vein only, in the ilt, the vena portæ *secretes*.

CAVITY OF THE ABDOMEN.

he *abdomen* constitutes the largest cavity in the , and contains a great number of the principal ra. It is bounded above by the diaphragm and ribs; below, it is continuous with the pelvic r; in front, and on the sides, it is enclosed by bdominal muscles; and posteriorly, its walls are d by the dorsal muscles and lumbar vertebræ.

diaphragm forms a muscular septum between rax and the abdomen, and is composed of two s. The *greater* portion *arises* from the ensiform e, from the cartilages of the six inferior ribs, s which interdigitate with the transversales), n the *ligamentum arcuatum*, a tendinous line *from the tip of the* twelfth rib to the trans-

verse process of the first lumbar vertebra, and then
to the body of the second lumbar vertebra. It
inserted by converging fibres into the central tendo
The *lesser* portion arises by two musculo-tendino
slips (*crura*) from the bodies of the four superi
lumbar vertebræ, the right crus being longer than t
left one. They ascend, and are also *inserted* into t
central tendon. The diaphragm presents *three* ope
ings; one (square and incapable of closing) in t
central tendon for the inferior cava and filaments
the phrenic nerve; a second, between the crura, f
the œsophagus and pneumogastric nerves; and a thi
opening, for the passage of the aorta, vena azygo
thoracic duct, and, occasionally, the greater splanchn
nerves.

The muscles which compose the abdominal pariet
in most part are, the obliqui, transversales, and rec
muscles; the pyramidales being merely rudimentar
and often absent.

The *external oblique* muscle passes obliquely dow
wards and forwards from the external surface of t
eight lower ribs, and is inserted along the linea alb
and crest of the ilium; from the anterior superi
spinous process of this bone it passes to the spine
the pubes, forming an aponeurotic arch, called *Poupart
ligament*. The *linea alba* is a tendinous line, whi
extends from the ensiform cartilage to the pubes.
serves to strengthen the abdominal parietes, and is t
situation generally adopted for performing the oper
tion of tapping the abdomen. The *lineæ semilunar*
are curved tendinous lines extending along the out
sides of the recti muscles.

The *internal oblique* muscle arises from the out
half of Poupart's ligament, the two anterior thirds
the crest of the ilium, and by a thin aponeurosis fro
the spinous processes of the lumbar vertebræ. Fro
these points the fibres pass, with different degrees
obliquity, to be inserted into the pubes, linea alb

lower borders of the six inferior ribs. Along the ter part of the lineæ semilunares, the tendons of internal oblique muscles separate to embrace the , but inferiorly they pass in front of these muscles. e fibres of this muscle pass through the exter- bdominal ring, under the name of *cremaster muscle*, are lost on the tunica vaginalis reflexa.

he *transversalis* muscle arises from the iliac half Poupart's ligament, the anterior three-fourths of crest of the ilium, the lumbar vertebræ, and the ilages of the six inferior ribs. It is inserted the linea pectinea, linea alba, and crest of the es.

he *rectus* muscle arises from the ensiform carti- , and from the cartilages of the fifth, sixth, and nth ribs, and is inserted by a strong, flat tendon the crest of the pubes. It is intersected by tendi- lines (*lineæ transversæ*), which are rudiments of the ominal ribs of reptiles.

he *pyramidalis* passes up from the crest of the es to the linea alba, into which it is inserted about way between the umbilicus and the pubes. One oth of these muscles are frequently absent.

he vessels which chiefly supply the abdominal etes are, the internal mammary, epigastric, and erior branches of the lumbar arteries. The *internal mmary* descends from the subclavian, along the of the sternum, passes through the diaphragm, anastomoses with the epigastric in the sheath of rectus muscle. The epigastric arteries are super- l and deep. The former pass up from the femoral ry to the integuments of the abdomen. The deep gastric arises from the external iliac, ascends quely inwards on the peritoneum, and enters the th of the rectus near its lower third. This vessel sometimes been wounded by the trochar, in para- esis abdominis, *and is carefully* to be avoided in *ating for inguinal hernia.* The lower part of the

abdominal walls also receive branches from the circumflexa ilii artery.

The internal surface of the abdominal parietes and most of the viscera contained within the cavity of the abdomen are lined by a serous membrane, called *peritonium*. The reflexions of this membrane, which in the male forms a shut-up sac (in the female it is perforated by the *Fallopian* tubes), may be described in the following manner:—The layers which line the anterior and posterior portions of the diaphragm, having formed the *lateral ligaments* of the liver, embrace this viscus and then pass, under the name of *lesser omentum*, to the small curvature of the stomach; they then separate to embrace the stomach, meet at its great curvature, descend in front of the intestines, forming the *great omentum*, and ascend again to embrace the transverse arch of the colon; from this they pass to the vertebral column, under the name of *meso-colon*, and then separate. The anterior layer invests the small intestines, returns to the vertebral column under the name of *mesentery*, surrounds part of the rectum (*meso-rectum*), partially lines the bladder, and ascends on the anterior abdominal wall to the point where the description began. The posterior layer ascends in front of the aorta, pancreas, &c., to the posterior portion of the diaphragm. In the course just described, the peritoneum necessarily forms numerous folds or duplicatures, many of which have been named. In addition to these may be mentioned the gastro-splenic omentum, the false ligaments of the bladder, the broad ligaments of the uterus, and the appendices epiploicæ. As the peritoneum passes from the liver to the stomach it forms an opening, or, properly speaking, a constriction, called the *foramen of Winslow*, which leads into the cavity of the great *omentum*. Below the transverse colon, the great *omentum is* composed of four layers; two descending *from the greater* omentum of the stomach, and two

ascending to embrace the transverse colon. These may be separated in the fœtus by blowing in through the foramen of Winslow. The lesser omentum embraces the hepatic artery and vena portæ; the ductus communis choledochus; the hepatic plexus and lymphatic vessels; all of which are, moreover, enclosed in a fibrous sheath, called *Glisson's capsule.*

The viscera of the abdomen are, the stomach and intestinal canal, the liver, spleen, pancreas, and kidneys.

The *stomach* is a musculo-membranous viscus, situate in the left hypochondriac and epigastric regions. It is distinguished into cardiac and pyloric extremities, greater and lesser curvatures, greater and lesser ends. The *cardiac* extremity is continuous with the œsophagus; the pyloric with the duodenum. The *great* end (*cul-de-sac*) is the bulging portion which corresponds to the spleen; the *small* end is the portion in the neighbourhood of the pylorus. The *smaller curvature* is concave, and situated superiorly; the *greater curvature* is the convex inferior border, which corresponds to the spleen and transverse arch of the colon. The stomach is composed of three coats, the serous, muscular, and mucous. The serous tunic has been already noticed; the *muscular* coat is thin, and composed of fibres, some of which are longitudinal and superficial, the rest circular and deeper-seated; there are also some oblique muscular fibres; the longitudinal are continued from the corresponding fibres of the œsophagus. The *mucous* coat of the stomach presents a pink, marbled appearance, and contains a great number of mucous follicles. Near the pyloric extremity is seen a circular prominence of the muscular and mucous coats, which has been improperly called the *valve of the pylorus.*

The arteries of the stomach are derived from the gastro-epiploic, *pyloric, coronary,* and splenic arteries. *They are extremely tortuous,* and terminate in the

mucous membrane. The lymphatics join the glands which are arranged along the two curvatures; the nerves of the stomach are supplied by the pneumogastric, and the cœliac plexus of the sympathetic.

The intestinal canal extends from the pylorus to the anus. It is distinguished into small and large intestines. The *small intestines* are subdivided into duodenum, jejunum, and ileum. The *duodenum* ascends from the pylorus to the under surface of the liver, then descends in front of the right kidney, and passes transversely across the vena cava and aorta to join the jejunum on a level with the second lumbar vertebra. At the angle of union formed by the descending and transverse portions of this intestine, a small papilla is observed, at the summit of which are seen the united, or isolated, orifices of the ductus communis choledochus and the ductus pancreaticus.

The *jejunum*, so called from its being commonly found empty, occupies about two-fifths of the small intestine, and extends from the left side of the second lumbar vertebra to the ileum. This latter portion includes the remaining three-fifths of the small intestine, and terminates in the right iliac fossa by joining the cæcum. The duodenum is only partially covered by the peritoneum, except the first portion; the jejunum and ileum are contained in the folds of the mesentery, and form the intestinal convolutions which occupy the greater part of the inferior abdominal regions. The structure of the small intestine is analogous to that of the stomach, being formed of serous, muscular, and mucous tunics. The muscular fibres are longitudinal and circular. The former run immediately under the peritoneal coat in the direction of the long axis of the canal; they are interrupted in various parts, and are chiefly collected along the convex edge. The circular fibres take a transverse direction, and are connected to the mucous membrane by a dense

layer of submucous tissue (*nervous coat* of the older writers).

The *mucous* coat of the alimentary canal presents certain differences, as we examine it in different parts of the tube. It is composed, like the skin, of three layers; viz., 1, an epithelium, 2, a basement membrane, elevated like that of the skin into innumerable papillæ, called villi, which are so thick that they resemble the pile of velvet, and which have caused this layer to be called the papillary layer, and 3, a fibrous layer, equivalent to the chorion or cutis vera of the skin. It is arranged in *longitudinal* folds in the œsophagus; in the stomach it forms *rugæ*, or wrinkles, longitudinal and transverse, but chiefly the former; and in the greater part of the small intestine it is thrown into transverse folds, denominated *valvulæ conniventes;* these, however, do not exist in the lower part of the ileum.

The epithelium in the œsophagus is thick and squamous, continuous with that of the mouth; in the stomach, especially in its greater extremity, it is very much more delicate. The villi of the stomach and small intestines have the same essential structure as the papillæ of the skin; that is, they are minute projections of the basement membrane, containing a loop of capillary vessels, a little cellular tissue, and, probably, nerve and absorbent. Only in the skin they are organized for touch; in the tongue the fungiform papillæ, with their very thin epithelium, are exquisitely adapted for taste, and in the stomach and intestines they are organized so as to contain the primary elements of the absorbent vessels, and act like spongioles of a root in the soil. The villi are less numerous towards the end of the small intestines.

The *fibrous sub-mucous* layer supports the mucous coat, and contains the mucous glands of the intestinal canal. These *are of three kinds*:—1, *Lieberkuehn's*

*follicles,** small foramina spread over the whole extent of the *small intestine*; 2, *solitary glands* (*glandulæ Brunneri*† *segregatæ*), follicles visible to the naked eye, distributed singly in the mucous membrane, and most numerous in the upper part of the small intestines; 3, *aggregate glands* (*glandulæ Peyeri*‡ *aggregatæ*; these are collected together into small oval patches, present a dotted appearance, and are chiefly found in the lower part of the ileum. Their long axis corresponds with that of the intestine, and they are never covered by valvulæ conniventes. The follicles of which they consist are sometimes found entirely closed, sometimes with an aperture.

The arteries of the small intestines are derived from the cœliac axis and superior mesenteric: its veins join the vena portæ. The nerves of the small intestine come principally from the superior mesenteric plexus.

The *large intestine* is distinguished into cæcum, colon, and rectum. The *cæcum* is a pouch of the large intestine, situate in the right iliac fossa, which receives the termination of the ileum. It is covered on its anterior and lateral surfaces only by the peritoneum, and at its lower part is perceived a long worm-shaped tube, the *appendix vermiformis*, which is larger in the fœtus than in the adult.

* To the same order of follicles, perhaps, belong the simple tubercular follicles described by Dr. Boehm as occupying the whole extent of *the mucous membrane of the large intestine*, and which he represents as seen arranged perpendicularly side by side, their cæcal bases resting on the subjacent vascular tissue.

† Some follicles of considerable size are found in the *large intestines*, especially in the cæcum and its appendage; under the name of glandulæ solitariæ, these have been confounded with the duodenal glands of Brunner.

‡ The nature of these thickened, generally oval, patches of mucous membrane has, up to the present, been quite unknown. Of late much importance has been attached to them, owing to *their* undergoing certain morbid changes in typhoid fevers. *According to Boehm*, the single sacculi, found in the lower part *of the small intestines*, are similar to those which, when aggregated, form the patches of Peyer.

The interior of the cæcum is partially divided by a fold of the mucous and muscular tissues, which is called the ileo-colic valve (*Bauhin's valve*), and prevents the return of excrementitious matter into the small intestine. The external surface is marked by three *longitudinal muscular bands*, which seem to commence on the appendix, and are continued along the colon, and spread out into a thick layer to embrace the rectum. These bands are shorter than the intestine, and hence give it a puckered appearance.

The *colon* extends from the right iliac region to the left, where it terminates in the rectum. It is distinguished into four portions—the ascending, transverse, descending, and sigmoid flexure. The *ascending* colon passes up from the cæcum, supported on the right kidney, through the right lumbar region, nearly as high as the liver, and then crosses, under the name of *transverse arch*, the epigastric region beneath the stomach. The upper convex edge of the arch corresponds with the liver and great curvature of the stomach; the lower surface rests on the mass of the small intestine, and appears to give attachment to the great omentum. The *descending* colon commences beneath the spleen, and passes down before the left kidney to join the *sigmoid flexure*, which will be found lying loose in the left iliac fossa, curved somewhat into the form of the letter S, and terminating at the brim of the pelvis in the rectum. This latter intestine descends in front of the sacrum, rather to the left side, and terminates in the anus.

The arteries of the great intestine are supplied by the superior and inferior mesenteric, the iliac, and pudic arteries. Its veins join the vena portæ, and internal iliac veins. The lymphatics terminate in the receptaculum chyli. The nerves are supplied by the mesenteric and hypogastric plexuses: the lower part of the rectum, however, *is supplied by the* coccygeal nerves of *the spinal chord.*

The arteries of the alimentary canal, within the abdomen, are derived from the aorta and its branches. The first branch of the abdominal aorta supplying the chylopoietic viscera is the cœliac axis, which divides almost immediately into three vessels—the gastric, hepatic, and splenic.

The *gastric* artery (*coronaria ventriculi*) ascends between the layers of the lesser omentum to the cardiac end of the stomach, and then turns back along the lesser curvature to inosculate with the superior pyloric branch of the hepatic. This artery frequently sends a branch to the left lobe of the liver, in which case its trunk is as large as that of the hepatic.

The *hepatic* artery passes up to the inferior surface of the liver, and divides into two branches (right and left), which enter the transverse fissure, and are distributed throughout the organ. The branches of the hepatic artery are,—1. Pylorica. 2. Gastro-duodenalis. 3. Cystic. The *pyloric* branch supplies the pyloric end of the stomach, and joins the coronaria ventriculi. The *gastro-duodenalis* winds underneath the pylorus, and divides into (*a* and *b*) gastro-epiploica dextra, and pancreatico-duodenalis : *a*, the *gastro-epiploica dextra* runs along the greater curve of the stomach to join the left gastro-epiploic artery from the splenic; *b*, the *pancreatico-duodenalis* is distributed to the duodenum and head of the pancreas ; at the root of the mesentery it inosculates with the pancreatic branches of the superior mesenteric artery.

The right hepatic artery gives off the *arteria cystica* to the gall-bladder ; this small artery accompanies the cystic duct to the neck of the gall-bladder, where it divides into two branches, one of which ramifies between the coats of this viscus, the other passes between the gall-bladder and the liver, to both of *which its branches* are distributed.

The splenic, or third branch of the cœliac axis runs *along the upper edge* of the pancreas to the spleen, to

the substance of which it is distributed. In this course, it passes over the crus of the diaphragm, the semilunar ganglion, and the renal capsule of the left side.

In its course, the splenic artery gives off—1st, pancreaticæ parvæ; 2nd, the pancreatica magna; 3rd, vasa brevia, which pass between the laminæ of the gastro-splenic omentum to the great end of the stomach; 4th, arteriæ splenicæ, five or six branches to the spleen; 5th, the gastro-epiploica sinistra, which appears to be the continued trunk of the artery; it turns forwards, downwards, and to the right side, passes between the laminæ of the great omentum and convex edge of the stomach, and joins the gastro-epiploica dextra, a branch of the hepatic artery.

The greater portion of the intestines is supplied by the *superior mesenteric* artery, which arises from the anterior and right side of the aorta, a little below the cœliac axis. It takes a very tortuous course in the abdomen, passing first between the pancreas and duodenum, and then winding, in an arched direction, between the folds of the mesentery towards the right iliac fossa. In this course the artery gives off—

1. *Branches to the smaller intestines*; there are from fifteen to twenty vessels detached from the convexity of the arch to the jejunum and ileum; they form successive arches, communicating with each other, from the last of which arise small arteries, distributed to the coats of the intestine. From the concavity of the arch are derived the colica media, colica dextra, and ileo-colica arteries.

2. The *colica media* gains the transverse arch of the colon, and divides into right and left branches—the one to join the colica dextra, the other the colica sinistra, from the inferior mesenteric artery.

3. The *colica dextra* passes to the right side, in the meso-colon, and then divides into two branches; one descends to *join the ileo-colic, the* other ascends to *anastomose with the colica media.*

4. The *ileo colic* is the terminating branch of the inferior mesenteric artery, and divides into three branches; one ascends to join a branch of the colica dextra, the second anastomoses with some branches from the convexity of the mesenteric artery; the third is distributed to the lower portion of the ileum, the cæcum, the vermiform appendage, and also the ileo-colic valve.

The *inferior mesenteric* arises rather from the left side of the aorta, about one and a half or two inches below the renal arteries. It descends towards the left iliac fossa, where it divides into, 1, colica sinistra; 2, sigmoid; and 3, superior hæmorrhoidal arteries.

1. The *colica sinistra* passes transversely into the lumbar portion of the colon, and subdivides into two branches—one to join the colica media, the other to anastomose with the superior sigmoid artery.

2. The *sigmoid* arteries are distributed to the sigmoid flexure of the colon.

The superior *hæmorrhoidal* artery may be regarded as the termination of the inferior mesenteric; it passes down along the posterior surface of the rectum, giving numerous branches, and terminates near the anus by anastomosing with the other hæmorrhoidal vessels.

THE LIVER.

The liver is the largest gland in the body: it is situated in the right hypochondriac region and a part of the epigastric. The *upper surface* of the liver is convex, and rests against the diaphragm, to which it is attached by the suspensory ligament, which also divides it into right and left lobes. The *inferior surface* is concave, irregular, and marked by several eminences and fissures. The lobes of the liver are two, viz., the right and left: the lobules are the lobulus quadratus, lobulus caudatus, and lobulus Spigelii. *these portions* are separated by five fissures, which *will be presently* noticed.

The *right* and *left lobes* are separated above by the suspensory ligament, and below by the longitudinal fissure.

The *lobulus quadratus* is situate between the gall-bladder, the longitudinal and transverse fissures.

The *lobulus Spigelii* is a kind of mammillary eminence, which lies beyond the transverse fissure, concealed by the hepatic vessels and lesser omentum.

The *lobulus caudatus* is merely a prolongation of the base of the former lobe to the right lobe of the liver. These lobules are confined to the right lobe, the left is not lobulated.

The five fissures of the liver are, the longitudinal; transverse; for the ductus venosus; for the vena cava for the gall-bladder.

The *longitudinal fissure* runs from before backwards, and divides the liver into right and left lobules. In the fœtus it receives the umbilical vein and ductus venosus. The posterior portion, behind the transverse fissure, is called the *fissure of the ductus venosus*.

The *transverse fissure* occupies the middle third of the transverse diameter of the liver, and receives the vena portæ, hepatic artery, roots of the hepatic duct, nerves, and lymphatics; all these latter parts are bound together by a dense sheath (*Glisson's capsule*). The *fissures* for the gall-bladder and cava are merely depressions to receive these parts.

The *ligaments* of the liver are, the two lateral, longitudinal, coronary, and round ligaments. They are, with the exception of the latter, formed by reflexions of the peritoneum.

The two *lateral ligaments* are, the two folds of peritoneum which pass from the diaphragm to the liver. The *longitudinal* (*suspensory, falciform*) *ligament* extends from the anterior notch to the junction of the two lateral ligaments. *At this latter* point, the viscus lies *immediately in contact with* the diaphragm, and

the fold of peritoneum surrounding the space is denominated the *coronary ligament.*

The *round ligament* is a fibrous chord, occupying the anterior border of the longitudinal ligament. It is the obliterated umbilical vein of the fœtus.

The vessels contained in the liver may be distinguished into three sets—the hepatic artery, for nutrition; the vena portæ, for secretion; and the hepatic veins, for the purpose of carrying away residual blood. In addition to these, we have the branches of the hepatic duct, which commence by a number of radicles in the granular structure of the liver. These minute ducts unite ultimately into two principal ones, which issue from the transverse fissure, and join to form the common hepatic duct; the latter, after a course of about an inch and a half, receives the ductus cysticus, and by their union is constituted the *ductus communis choledochus.*

The *gall bladder* is situate in a depression in the inferior surface of the right lobe of the liver. It is composed of serous, fibrous, and mucous tunics. The latter is covered with a great number of papillæ, and forms a kind of spiral valve at the neck of the organ.

The *structure* of the liver has been latterly studied with great care by Mr. Kiernan, and still more recently by MM. Dujardin and Verger. The following description is taken from the excellent memoir of Mr. Kiernan, on the structure and minute anatomy of the liver. This organ is composed of lobules, of a connecting medium (*Glisson's capsule*), of vessels, ducts, lymphatics, and nerves.

The *lobules* are small granular bodies of an irregular form. The base of each lobule is flat, and rests upon a hepatic vein; the surface is marked by projecting processes, and is enclosed in a cellular sheath, or *capsule*, derived from Glisson's capsule. Each lobule *is thus separated* from the rest by a distinct capsule, *and the fissures* between them are called, inter-lobular.

The centre of each lobule is penetrated by a small vein, which passes through it to join the hepatic vein at its base, already noticed.

Each lobule is composed of a plexus of biliary ducts, of a plexus formed by branches of the portal vein, of a branch of the hepatic vein, and of minute arteries.

Glisson's capsule is to the liver what the pia mater is to the brain. It may be distinguished into vaginal, inter-lobular, and lobular portions. The *vaginal portion* encloses the vena portæ, hepatic artery, and duct, in their canals.

The *inter-lobular portion* forms the capsules of the lobules, and supports the same tubes before they enter the lobules.

The *lobular portion* accompanies the vessels into the interior of each lobule.

The branches of the *portal vein* are partly distributed to the surface of the lobules, partly to their interior. The *inter-lobular* branches ramify on the exterior of the lobules, and communicate with each other in a very free manner throughout the liver. The *lobular* branches form a plexus within each lobule, and terminate in the hepatic vein at the base.

The *hepatic duct* accompanies the portal vein and hepatic artery throughout the liver to the substance of the lobules; its branches ramify with them on the capsules, and, having entered the lobules, form the *lobular biliary* plexuses, and finally terminate in blind extremities, as do the ducts of other glands.

The distribution of the *hepatic artery* resembles closely that of the portal vein and hepatic duct. The *inter-lobular* branches are principally distributed in the coats of the inter-lobular ducts; the lobular branches supply the lobules, and probably terminate in the portal vein.

The *hepatic veins* commence in the interior of each lobule by the *intra-lobular veins. These* latter pierce the *bases of the lobules to form the sub-lobular* veins,

and these again, by uniting, form venous trunks, which subsequently constitute the hepatic veins. They have no communication with the artery, and their only office is to convey the blood from the lobular venous plexus.

The *nerves* and *deep-seated lymphatics* of the liver ramify in the portal canals; the *superficial lymphatics* ramify in the proper capsule of the liver.

THE SPLEEN is met with only in vertebrate animals, and in them it is almost universally present. It is a highly vascular viscus, of a soft and spongy texture, and of a dark red colour, inclining to black, rarely uniform, and almost always marbled. It is placed deeply in the left hypochondrium, beneath the diaphragm, above the descending colon, between the great end of the stomach and the cartilages of the ribs, and before the left kidney and suprarenal capsule. It is invested by a strong fibrous membrane, which sends numerous band-like processes into its interior, so as to support the soft, pulpy, red tissue of the organ. In many animals, whitish, rounded corpuscles (*Malpighian corpuscles*) are seen in the red substance of the spleen. In the *human spleen*, these corpuscles are distinguished with great difficulty. Its blood-vessels are derived from the cœliac, the left capsular, phrenic, and first lumbar arteries; its veins form one of the principal roots of the vena portæ.

THE PANCREAS is a conglomerate gland, which lies across the vertebral column behind the stomach, and extending from the spleen to the duodenum. It resembles in structure a salivary gland; and from its lobules are derived a number of ducts, entering at right angles into the pancreatic duct, which occupies the whole length of the gland, and opens into the duodenum either with the ductus communis choledochus, or extremely close to it. Near the duodenum it is joined by a smaller duct (*ductus pancreaticus minor*) *from the great end* of the gland. The nerves of the *pancreas come* from the solar plexus. Its arteries,

though small, are very numerous, being derived from the splenic, superior mesenteric, gastric, right gastro-epiploic, and left capsular arteries. The splenic artery and vein run along its upper surface.

PHYSIOLOGY OF DIGESTION.—*Of Digestion.*—Whatever be the conditions under which hunger and thirst are felt, it is certain that, in a healthy state, they are a true index, not only to the condition of the stomach, but to the immediate wants of the system at large. It is divided into *mastication, deglutition, chymification, chylification, separation, absorption,* and *defœcation.*

Of Mastication.—The contact of solid food with the interior of the mouth excites the act of mastication, performed by alternating contractions of the muscles, which pull the jaw upwards towards the bones of the head and face, and downwards towards the os hyoides and sternum. During this process, the food is mixed with the saliva and fluids of the mouth, or insalivated.

Of Deglutition.—The food, comminuted and moistened in the mouth by the means above mentioned, is prepared for the act of deglutition.

In which there are three acts:—In the *first,* the parts of the food, collected to a morsel, glide between the surface of the tongue and the palatine arch, till they have passed the anterior arch of the fauces. In the *second* act, the morsel is carried past the constrictors of the pharynx. In the *third,* it reaches the stomach through the œsophagus. These three acts follow each other with extreme rapidity. During the second act of deglutition, the tongue, the muscles of the anterior and posterior palatine arches, the superior muscles of the soft palate, and the constrictors of the pharynx, are all in action. In the third act, in which the food passes through the œsophagus, every part of that tube, as it receives the morsel, and is dilated by it, is stimulated to contract.

By the root of the tongue being retracted, and by the larynx being raised and carried forwards under it,

the *epiglottis* is pressed over the rima glottidis during deglutition. It is also proved, that the rima glottidis itself is closed during this process.

Chymification.—The fluids taken into the stomach are for the most part absorbed from it, and do not ever pass the pylorus. The solids are, with the exception of the insoluble parts, reduced to a substance called *chyme*, by the muriatic acid of the gastric juice, aided by the oxygen of the air which is swallowed in the saliva, and by the influence of the mucus of the stomach.

The passage of the chyme out of the stomach does not take place uninterruptedly, but by a successive series of peristaltic movements along the stomach and duodenum, each of which is preceded by a series of slighter movements in the opposite direction.

Of Chylification.—After passing the pylorus, and mixing with the *bile, pancreatic juice*, and *mucus of the intestines*, the chyme is changed into chyle; this the recrementitious part of the food is *separated* from the *excrementitious* by the agency of the resinous portion of the bile. The former, or chyle, is absorbed by the lacteals as it passes along the cavity of the small intestines; the latter constitutes the fæcal matter, and is ultimately expelled forming defæcation.

Action of the Bile on the Chyme.—We have as yet no satisfactory information relative to the precise action of the bile on the chyme. They, however, neutralize each other; and most of the bile is absorbed with the chyle; a small portion remains and gives colour to the excrements, as stated.

Influence of the Pancreatic Secretion.—Probably the same as that of the saliva, whatever it may be.

The *chyle* is absorbed from the intestines, and passes through the lacteals and mesenteric glands into the receptaculum chyli; from this point it is conveyed by *the thoracic duct* into the venous system. Reuss, *Emmert*, *Tiedeman*, and Gmelin agree in stating

that the coagulability of the chyle increases with its progress through the absorbent system ; that the chyle of the lacteals does not coagulate ; and that even after it has traversed the mesenteric glands, it has rarely the property of coagulating spontaneously.

The use of the spleen is wholly unknown.

GENITO-URINARY ORGANS.

The URINARY ORGANS consist of the kidneys, ureters, bladder, and urethra ; the genital organs vary in the sexes, and will be presently described.

The KIDNEYS are situate one on each side of the vertebral column in the lumbar regions, corresponding to the two last dorsal and two first lumbar vertebræ. They are covered in front only by the peritoneum, but are completely invested by fibrous capsule. When divided perpendicularly into moieties, they exhibit two distinct substances, cortical and mammillary. The *cortical*, or *external*, substance, is of a red colour, presenting several prolongations, between which are seen the conical bundles of the mammillary substance. It is very friable. The *mammillary* (*tubular*, *internal*) substance is composed of a number of *cones*, the bases of which, enveloped by the cortical substance, correspond to the circumference of the kidney, while their apices are turned towards the pelvis. Each cone terminates in a *papilla*, which is pierced by a number of small openings, the terminations of the tubuli.

The points of the papillæ are lined with mucous membrane, which forms a cup-like pouch (*calyx*) around the extremity of each. The number of the *calyces* is various ; but they unite in the middle of the kidney into three cavities (*the infundibula*), which again unite to form one single cavity, the *pelvis*, occupying the posterior part of the fissure of the kidney, behind the renal artery and vein. The pelvis is continuous with the *ureter*, a cylindrical canal, which descends from the

kidney along the posterior wall of the abdomen, crosses the common iliac artery and vas deferens, and penetrates obliquely the posterior and lateral part of the coats of the bladder.

The ultimate structure of the kidneys is as follows:—The ultimate ramifications of the uriniferous tubes ramify tortuously in the cortical substance, and terminate in blind extremities. Intermixed with them are the capillary arteries and veins. One of the small arteries perforates the extremity of each of the tubes, and then forms a convoluted ball, which is a naked capillary vessel. These little arterial balls, one in the end of each uriniferous tube, are visible to the naked eye, and are known under the name of the *Malpighian corpuscles*. From each of the arterial balls, the blood is returned by a single vein, which afterwards subdivides and ramifies on the exterior of the tubes, and finally joins the renal veins. Mr. Bowman supposes that the arterial tuft secretes the watery part of the urine, whilst the venous capillaries which ramify on the exterior of the tube, supply the saline and animal ingredients, which are first deposited in the epithelium lining the tubes, and then washed down by the water secreted by the Malpighian body. The veins which emerge from the Malpighian tuft are called *portal*, because they ramify again and yield a secretion like the portal veins of the liver.

At the upper part of each kidney will be perceived the *suprarenal capsule*, a rudimentary or fœtal structure, the uses of which are entirely unknown.

The kidneys receive their blood directly from the aorta by the renal arteries; their nerves are supplied by the renal plexuses, and the lesser splanchnic. The arteries of the renal capsules are rather numerous, and come from the aorta, phrenic, and renal arteries.

The viscera of the male pelvis are, the bladder, with *its appendages*, and the rectum. The latter has been *already noticed*.

The *bladder* is a hollow muscular viscus, occupying the anterior and upper part of the pelvis. It is partially surrounded by the peritoneum, which is reflected from it *posteriorly* and *on the sides*, forming the *false ligaments;* it is moreover supported by reflexions of the pelvic fascia (*anterior, and lateral true ligaments*), the remnants of the umbilical arteries, and the urachus.

The *muscular coat* of the bladder, like that of the intestinal canal, is composed of two layers: the *external* is longitudinal; the fibres of this layer pass up along the anterior wall of the organ, turn round its fundus, and descend along the posterior surface to the neck of the bladder; they also send off numerous lateral fibres. The *internal* fibres are very irregular in direction, being transverse or oblique, and frequently ranged in a spiral form. A few circular fibres surround the neck.

The *sub-mucous* tissue of the bladder is pretty dense and extensile, and connects together in an intimate manner the mucous and muscular coats of the bladder.

The *mucous coat* is smooth, and is continued into all the openings which communicate with the viscus; in its empty state it presents numerous rugæ, but these disappear when it is full. At the base of the bladder is seen a smooth triangular space (*trigonus*), the two posterior angles of which look towards the ureters, while the anterior corresponds to the urethra, at a point called the *uvula vesicæ*. The external surface of the trigonus is also of a triangular shape, and lies upon the rectum, being comprised on each side by the vesiculæ seminales and vasa deferentia, and below by the middle lobe of the prostate. It is here that the recto-vesical operation for puncturing the bladder is to be performed. The arteries of the bladder are derived from the hypogastric, ischiatic, middle hæmorrhoidal, and internal pudic; its veins join the hypogastric veins; the nerves come from the *hypogastric* and sciatic plexuses.

The *urethra is the excretory* canal of the bladder,

and extends from the neck of that organ to the glans penis. It is distinguished into prostatic, membranous, and spongy portions. The *prostatic portion*, from an inch to fifteen lines in length, is that which traverses the prostate gland; in its floor we remark an eminence, *verumontanum*, or *caput gallinaginis*, on either side of which are the openings of the prostatic ducts, and in front those of the ducti ejaculatorii. The *membranous portion* of the urethra is about eight to ten lines in length, and soon terminates in a *spongy portion*. This latter is enclosed in the spongy body of the penis, and commences at the bulb, where it presents a dilatation; it becomes contracted in the body of the corpus spongiosum, but forms another dilatation, called *fossa navicularis*, in the glans penis. The bulbous portion receives the ducts of *Cowper's glands*, two small mucous glands, situate immediately beneath the membranous portion of the urethra, and behind the bulb.

MALE ORGANS OF GENERATION.—The *prostate gland* is connected to the neck of the bladder, and surrounds the commencement of the urethra in the male. It is somewhat triangular in shape, and is distinguished into three lobes. This gland is of a whitish colour, and very dense structure; it contains internally a number of small follicles, which are filled with a ropy viscid fluid. The ducts of the gland, from ten to twelve in number, arise from these follicles, and open, as has been already mentioned, along the sides of the verumontanum. The prostate gland secretes a mucous fluid, which is supposed to mix with the semen, and thus assist in generation.

The *vesiculæ seminales* are found at the base of the prostate, and are composed of flexuous canals, separated above, but approximating below, near the prostate, where they almost meet. They terminate in two *ducts*, which are soon joined by the *vasa deferentia, and form the ejaculatory ducts*, which open into the *prostatic portion* of the urethra. The principal use of

the vesiculæ seminales is to receive the semen as it is secreted by the testes; but they also secrete a fluid which mixes with the semen and contributes to generation.

The penis is composed of three bodies, the corpus spongiosum, and two corpora cavernosa. The *corpus spongiosum* commences at the bulb, runs forwards with the urethra, which it surrounds, and terminates in the glans penis; it is composed chiefly of a cellular vascular tissue, supported and enclosed in a thin fibrous membrane.

The *corpora cavernosa* are composed of a soft, spongy, or *erectile tissue:* they arise from the tuber ischii, and from the ramus of the ischium and pubes; then ascend, become united, and form the chief bulk of the penis, at the superior and lateral parts. They are separated by an incomplete partition of perpendicular fibres (*septum pectiniforme*), which descends, in the median line, from a strong fibrous membrane that invests each body. The penis is supported by the *suspensory ligament*, which descends from the symphysis pubis to the corpora cavernosa. The arteries of the penis are branches of the internal pudic, which furnishes the arteries of the bulb, of the corpora cavernosa, and of the dorsum of the penis. The veins join the vesical plexus. The nerves are derived from the internal pudic nerve and inferior gluteal.

The *testes* are contained in a cul-de-sac, or purse-like investment, called the scrotum. This latter is distinguished into several strata, which are:—1, the skin; 2, the dartos; 3, the superficial fascia; 4, the fascia spermatica externa; 5, the cremaster muscle (tunica erythroides;) and 6, the tunica vaginalis reflexa.

The testes are secreting bodies, composed of minute tubes (*tubuli seminiferi*), extremely convoluted, and arranged in lobules (*lobuli testis.*) These tubes terminate in the *vasa recta, a series of* small, straight vessels *which join the rete testis.* The ducts forming this

latter body emerge from the superior and posterior angle of the testis, under the name of *vasa efferentia* (coni vasculosi), which are commonly from ten to fifteen in number; these soon become convoluted, and, joining together, form the *epididymis*. The upper end of this last-named tube is called *globus major;* the lower part, *globus minor:* and the duct which ascends from the latter to the ring is denominated *vas deferens*. The *proper tunics* of the testicle are, the tunica vaginalis, tunica albuginea, and tunica vasculosa. The *tunica vaginalis* is the serous bag which was drawn down with the testicle in its descent from the abdomen. The *tunica albuginea* is a dense fibrous membrane, which forms the proper capsule of the testicle: at the posterior border of the gland, this membrane divides into two laminæ, one of which, the external, is continued along the vas deferens; the other, internal, joining with the layer of the opposite side, passes into the substance of the gland. The septum thus produced is called the *corpus Highmorianum* (*mediastinum testis* of Sir A. Cooper.) The tunica albuginea also sends in several processes, which separate the lobuli testis. Sir A. Cooper also describes the *tunica vasculosa testis*, which lines the inner surface of the tunica albuginea, and sends vascular processes between the lobules. The membranes of the testicle thus bear some analogy to those of the brain; each organ has a serous, fibrous, and vascular membrane, but with this difference, that in the testicle the serous membrane is placed outside the fibrous.

The *spermatic cord* is composed of the vessels, nerves, lymphatics, and ducts coming to, and passing from, the testicle, enclosed in four membranous layers —viz., the spermatic fascia, the cremaster muscle, the fascia propria, and the remnant of the *tunica vaginalis of the cord*. The vessels contained in the cord are, *the spermatic artery* and vein, the cremasteric branch *of the epigastric*, and the branch to the vas deferens

m the vesical artery. The nerves are derived from
› spermatic plexus, and from the ilio-scrotal and
ıito-crural branches of the lumbar plexus. The *vas*
ferens ascends from the globus minor of the epididy-
s, along the cord; then passes through the inguinal
ıal, turns downwards along the posterior wall of the
ıdder, across the ureter, and terminates by uniting
ih the duct of the vesicula seminalis at the base
the prostate gland. The semen is a semi-opaque
id of a dull white colour, becoming more brown
advanced age, and contains "seminal granules"
a roundish form, and "spermatic animalcules,"
ıembling a pin in shape, the head being oblong,
d the tail tapering gradually to a fine point;
ese are supposed to be the chief agents in fecunda-
n.

FEMALE ORGANS OF GENERATION.—The female
ıans of generation, although apparently so diffe-
ıt from those of the male, present many points of
alogy to them. They are distinguished into ex-
ıal and internal. The *external parts* are, the mons
ıeris, labia, clitoris, nymphæ, hymen, and vagina.
ıey do not require any particular description. The
toris is analogous in structure to the penis, being
mposed of two corpora cavernosa, a gland, and ereo-
› muscles. The female urethra is about an inch
d a half in length, and runs nearly in a straight line
the bladder.

The *internal* organs of generation are, the vagina,
ɜrus, Fallopian tubes, and ovaries.

The *vagina* is a membranous tube, which leads from
› vulva to the neck of the uterus, being about five
six inches in length. It is lined internally with
ıcous membrane, which presents a number of *trans-*
·se rugæ (most plainly seen in the virgin) at the
ver part, extending from two median lines or *raphe*.
The walls *of the vagina are* composed of cellular
d erectile tissue, which connect it on all sides to

the neighbouring structures. The mucous membrane is covered by epithelium, which extends to the os uteri.

The *uterus* is a muscular pyriform body, situated between the bladder and rectum, and connected to both by the peritoneum. It is united laterally to the sides of the pelvis by the *ligamenta lata*—broad folds of the peritoneum, reflected from the anterior and posterior surfaces of the organ. They contain the Fallopian tubes, round ligaments, and ovaries. The uterus is also supported by two *round ligaments*, which pass from its angles to the internal abdominal rings, traverse the inguinal canals, and become fixed in the substance of the labia majora. The uterus is distinguished into a neck, body, and fundus. The *neck* (*cervix uteri*) is the elongated portion which projects into the vagina. It is slightly flattened from before backwards, and is from ten to twelve lines in length, by eight to ten in breadth.. The inferior margin presents a transverse slit (*os uteri*), bounded by two lips, of which the posterior is the longer and thicker. The *body* of the uterus is nearly two inches in length, and is placed between the bladder and rectum. The upper rounded margin of the uterus is called the fundus. The *cavity* of the uterus is small in proportion to the bulk of the organ. It is of a triangular shape, and is lined by a continuation of the mucous membrane of the vagina. The *proper tissue* of the uterus is muscular, but the muscular fibres can only be well seen in the uterus at the full term of gestation; they run principally from the fundus towards the cervix, and there are also distinct concentric circles surrounding the orifices of the Fallopian tubes. The irregular contraction of these latter fibres produce, probably, what is called hour-glass contractions of the *uterus*. The arteries of the uterus come from the *spermatic and hypogastric*; its nerves from the sciatic *and hypogastric* plexus.

allopian tubes are two membranous canals, tend from the sides of the uterus, along the aments, towards the ovaries. The free ex- f each is wide, and presents a peculiar fringed ce, whence their name, *corpora fimbriata*. eive the ovum from the ovary, and conduct uterine cavity. The Fallopian tubes are l of a thin layer of erectile tissue, lined inter- h mucous membrane, which is thrown into nal plicæ, and externally with a prolongation ritoneum. The serous membrane, however, eflected back from the fimbriated bodies, and esents a communication with the exterior— words, is not a complete sac.

aries are oblong glands contained in the pos- ds of the broad ligaments. Each is connected terus by the broad ligament, and by a small ord, without a canal, the ligament of the The ovary is moreover enclosed in a dense heath, which sends septa into its structure : s is divided, the ovary is seen to contain a of small vesicles (*vesicles of Graaf*), in which loped the ova, or rudiments of the embryo. nception, the ovaries frequently present yellow *rpora lutea*), the real nature of which is not rstood.* The arteries of the ovaries are fur-

raafian vesicles are variable in number, there being twenty, at other times not more than a dozen. They ferent degrees of development, some deep, not larger nder seeds, others more superficial, as large as peas, through the tunica propria, slightly projecting. They coats, or membranes, adhering to one another, the

nished by the spermatic; their nerves by the spermatic plexus.

THE MAMMARY GLAND.—Although, strictly speaking, not one of the organs of generation, this is the most appropriate place for a description of this gland. The mammæ, or mammary glands, are situated one on each side of the female breast; they are hemispherical in shape, and about four inches in diameter.

Nearly in the centre, but rather to the inner side, is the nipple, composed of erectile tissue, covered with delicate skin, and containing the openings of the lactiferous tubes. This is surrounded by the areola, a darkish circle of integument, provided with sebaceous follicles. The mamma is composed of about twenty distinct lobes, each of which is provided with a separate duct. The lobes are composed of numerous milk vesicles, the lobules or glandules, about the size of a pin's head.

THE MILK.—The ordinary character of human milk need not be described. It consists, like other animal milk, of a fluid and solid portion, forming the curds and whey; the first contains the nutritious portions. When recent, and examined under the microscope, it is seen to contain a number of small globules, flowing in the liquid, the ordinary milk globules, and larger globules of a yellowish colour, the "*colostrum corpuscles.*" The cream globules are of a larger size than the ordinary milk globules.

PHYSIOLOGY OF GENERATION.—The semen being ejected into the vagina of the female, is taken up by the

a reddish mass connected with the inner coat, and for a time having either a small central cavity, or the centre is occupied by a little albumen. The external opening, through which the ovum had escaped, closes, the central cavity gradually disappears, and there is only a uniform globular structure, called, from its colour, *corpus luteum*. It has been ascertained that during menstruation the *vesicles go through* the same course, bursting and discharging *a useless ovulum*: consequently, the existence of corpora lutea *is no proof* that the female was not a virgin.

the uterus, where it comes into contact with
, as it escapes from the ovary, which is thus
id. Some suppose that actual contact is not
, but that impregnation by *absorption*, or by
eminalis, will take place; the first of these
is contradicted by the fact, that impregna-
not take place if the semen be deposited in
· part of the body; and the second, by the
tion of most of the fish tribe in which ac-
act with the ovum takes place, without union
ces.

ANATOMY OF THE FŒTUS.

verage length of the fœtus at birth is about
inches, and its weight from six to seven
The head and abdomen are remarkably large
tion to the rest of the body. The process of
on in the fœtal skeleton is very slow and
The first ossified point is seen in the clavicle
id of the first month; and the next point
ortly afterwards in the lower jaw. During
week, ossification commences in the bones
extremities, and during the latter half of the
onth in the bones of the head, face, vertebral
and thorax. The bones of the ear are the
which are completely ossified at the birth of

.

rculating system of the fœtus presents the
· peculiarities.

two auricles of the heart communicate by
the *foramen ovale*.

pulmonary artery opens into the descending
the *ductus arteriosus*.

internal iliac arteries give off two large ante-
riches (the *umbilical*), which ascend along the
wall of the abdomen, pass out through the
s, and are connected by the cord to the mater-
nta.

4. The umbilical vein is connected to the inferior vena cava by a branch called the *ductus venosus*.

The above-mentioned peculiarities of structure necessarily occasion corresponding peculiarities in the mode of the fœtal circulation. The blood is carried from the placenta by the *umbilical vein*, partly to the liver, and partly, through the means of the *ductus venosus*, to the inferior cava; that portion which circulated through the liver is also carried to the inferior cava by the hepatic veins, and meets the blood returning from the lower extremities. The blood of the inferior cava, having been discharged into the right auricle, is guided through the foramen ovale by the Eustachian valve into the left auricle; and thence into the left ventricle, and subsequently into the aorta; and this, which contains the blood which has last come from the placenta, is chiefly distributed through the branches of the arch of the aorta to the head of the upper extremities. The blood of the superior cava passes into the right auricle, from the right auricle into the right ventricle, and from this latter cavity into the pulmonary artery; but instead of circulating through the lungs, as it does in the adult, the blood contained in the pulmonary artery passes, through the *ductus arteriosus, into the aorta;* the rest is merely sufficient for the nutrition of the pulmonary apparatus. The aorta conducts the blood to all parts of the body, as in the adult. A small portion is distributed to the lower extremities, but the greater part, having entered the *umbilical branches* of the internal iliacs, is carried along the cord to the placenta.

After birth, the foramen ovale and ductus arteriosus become closed, and the umbilical vessels, together with the ductus venosus, are converted into fibrous cords.

The fœtal *pupil* is closed by a vascular membrane, *called membrana pupillaris*, which usually disappears *about the seventh* month.

The *thymus gland* is an organ peculiar to the fœtus. It occupies the lower part of the neck and the anterior mediastinum. The structure of this peculiar body has been already noticed.

The *liver* of the fœtus is extremely large in proportion to the other abdominal viscera. The left lobe is as large as the right one, and the falciform ligament occupies the median line.

The *kidneys* present a rudiment of the lobulated structure of some of the mammalia.

The *renal capsules* are very large, and at birth are nearly one-third the size of the kidney itself.

The *bladder* of the fœtus is long, and rises considerably above the brim of the pelvis, being an abdominal viscus. It is connected with a tube called the urachus, which passes out through the umbilicus, with the cord. This tube is sometimes permanent at birth, and the urine has been discharged through the navel.

The *testicles* of the male fœtus are situate in the lumbar regions, immediately below the kidneys. They usually, however, descend into the scrotum about the seventh month, and this descent is effected by means of the *gubernaculum testis*, a fibro-muscular cord, which passes from the testicle to the scrotum. The *ovaries*, in the female fœtus, are also situated below the kidneys.

The *uterus*, at a very early period of fœtal existence, presents a bifid appearance, but this is soon lost.

RELATIVE ANATOMY.

Having now described, though briefly, the structure of the organs contained in the principal cavities of the body, it remains to say a few words on the relations which exist between those *organs* and the external parts *enclosing them in the living* subject. Knowledge

of this kind is almost as necessary to the medical man as an acquaintance with the structural arrangement of organs; for without it he would be unable to avail himself of the immense assistance in the diagnosis of disease which is rendered by a just appreciation of physical signs.

The only organs contained in the cavity of the chest are, the lungs, and the heart, with its great vessels.

The lungs occupy the greater portion of the thoracic cavity, and are therefore in contact with nearly all the points of its solid case. There are, however, certain circumstances which the student should bear in mind while examining this region of the body. The disposition and attachment of the diaphragm, or muscular septum, between the thorax and abdomen, have been already mentioned; but the relation of this muscle to the surrounding parts is by no means the same in the living as in the dead subject. In the latter, it presents, when viewed from the side of the abdomen, a concave appearance; in the former, it is in a constant state of motion, ascending and descending, from the third and second false ribs behind, to the seventh and sixth true ribs in front.

The right side of the thoracic cavity corresponds to the right lung; the left side to the left lung, heart, and great vessels, which latter are situate immediately behind the sternum. The *anterior* border of the lung is *shorter* than the posterior edge; the former descends as far as the *sixth* true rib, while the latter, which is also thicker, descends as far as the *second* and *third* false ribs. The heart is situate in the left side of the thorax, and the limits of the organ in the living body may be accurately determined by percussion. The *right auricle* lies immediately behind the sternum, about an *inch and a half* or *two inches* above the union of the xiphoid cartilage with the sternum. The rest of the organ *corresponds to a space* which is bound superiorly by *the fourth rib*, and inferiorly by the seventh. We have

ansverse limits of the heart. Its lateral
are, the *middle* line of the sternum on the
nd an irregular line on the *left*, which runs
ownwards and outwards, from the fourth
out *two inches* from the sternum. The
the heart as limited by percussion, will be
upy a square of about two inches.
r and spleen are also, though partially,
the parietes of the thorax. The liver is
y the lower portion of the right side of the
m the *sixth* true rib downwards, and
far as the median line. According to the
of M. Piorry, the perpendicular diameter
near the sternum is from two inches and
ee inches; and towards the right side from
inches. The transverse diameter is from
ve inches. The spleen corresponds pos-
that portion of the thoracic parietes which
three or four inches from the seventh rib
angle of the scapulæ, and the false ribs

men has been divided into nine different
erpendicular and transverse lines intersect-
her, but it is unnecessary to subdivide it so
The following are the principal points
eserving of attention. If a line be drawn
oss the base of the thorax, it will comprehend
space, with the edges of the ribs ascending
xiphoid cartilage. In this space is con-
niddle portion and pyloric extremity of the
nd, towards the right, a portion of the left
liver. Immediately below this point lies
rse arch of the colon, running with a slight
right to left. The course of the colon may
ollowed downwards to the right lumbar
ere the presence of the cæcum will be dis-
its clear *tympanitic* sound, similar to that
r the stomach itself. This arises from the

fact that, even in the most healthy individuals, the cæcum contains a considerable quantity of gas.

The exact limits of the kidneys are not easily discoverable in the living body, from the thickness of the parts which cover them. They are placed on a level with the two last dorsal and two first lumbar vertebræ, about one inch and a half from the vertebral column on either side. From these points the ureters descend towards the angles of the pubis. The urinary bladder is not found in the abdomen in the normal state; but in certain affections, fever, &c., the urine is retained, and the bladder forms an oval tumour which gradually mounts above the pubis towards the umbilicus. By percussion, we can generally determine with certainty the degree of distension which this viscus undergoes.

For Physiology of the Secretions, see Animal Chemistry, p. 186.

?RINCIPLES OF CHEMISTRY.

ıTTER, ATTRACTION, AFFINITY, ATOMIC THEORY.

ı composition and properties of *matter*, of which the erial world, animate and inanimate, is composed, the especial study of the chemist and philosopher. ıttraction is of various kinds. (1) There is the action of *gravitation*, whereby masses of matter drawn together. This it is which causes the fall of ies towards the centre of the earth; (Sir Isaac vton was led to the discovery of this principle ıugh observing the fall of an apple); it keeps the osphere in connexion with the earth's surface, and ents it from flying off into space; it maintains the ın and planets in their orbits, and is the general se of *position* and *weight*. Weight signifies the e with which a given quantity of matter is attracted ards the earth's centre.

2) The attraction of *cohesion*, which unites together particles of any given mass of matter, rendering it l, soft, &c. This form of attraction is principally bited by solids; less by liquids; and not at all by form bodies.

3) The attraction of *heterogeneous adhesion*, whereby ous substances have the power of adhering to each ır. Thus water is greedily imbibed by sponge and a, and will mix readily with spirit. But this power ı *not exist between all bodies*; thus oil and water

will not mix; a sponge soaked in oil will not imbibe water; mercury will not adhere to, or *wet* glass. Certain solids (especially of a porous nature) have great force in retaining aeriform bodies. A bit of woollen cloth has a strong attraction for certain odours, and this power is also manifested by charcoal and spongy platinum. *Capillary attraction* is one variety of heterogeneous adhesion; it signifies the power which fine tubes or porous substances have of imbibing liquids.

(4) *Chemical Attraction*, which is exerted between *particles of dissimilar matter* at *insensible distances;* that is to say, in order to produce chemical action, two or more bodies of dissimilar nature must be present, and must be in close approximation: for chemical force does not act from a distance, like gravitation.

Here it is requisite to observe that matter may be *simple* or *compound;* and those substances are said to be *simple* which have never yet been decomposed by the chemist into substances yet simpler. The number of them at present known is fifty-eight; and their names are given in the following table, with their symbols. The figures appended signify their atomic weights, which will be explained presently.

TABLE OF THE ELEMENTARY SUBSTANCES, WITH THEIR SYMBOLS AND EQUIVALENT NUMBERS.

Aluminium	Al.	13·7	Chlorine	Cl.	35·42
Argentum	Ag.	108	Chromium	Cr.	·28
Antimony	Sb.	64·6	Cobalt	Co.	29·5
Arsenic	Ar.	37·7	Columbium	Ta.	185
Barium	Ba.	68·7	Copper	Cu.	31·6
Beryllium	Be.	6·9	Didymium	Di.	·50
Bismuth	Bi.	71	Fluorine	F.	18·68
Boron	B.	10·9	Glucinium	G.	26·5
Bromine	Br.	78·4	Gold	Au.	199·2
Cadmium	Cd.	58·8	Hydrogen	H.	·1
Calcium	Ca.	20·5	Iodine	I.	126·3
Carbon	C.	6·12	Iridium	Ir.	98·8
Cerium	Ce.	·46	Iron	Fe.	28

Lanthanum	La.	47	Ruthenium	Ru.	52·2
Lead	Pl.	103·6	Silenium	Se.	39·6
Lithium	L.	·6	Silicon	Si.	22·5
Magnesium	Mg.	12·7	Sodium	Na.	23·3
Manganese	Mn.	27·7	Strontium	Sr.	43·8
Mercury	Hg.	202	Sulphur	S.	16·1
Molybdenum	Mo.	47·7	Tellurium	Te.	64·2
Nickel	Ni.	29·5	Thorium	Th.	59·6
Nitrogen	N.	14·15	Tin	Sn.	57·9
Osmium	Os.	99·7	Titanium	Ti.	24·3
Oxygen	O.	·8	Tungsten	W.	99·7
Palladium	Pd.	53·3	Vanadium	V.	68·5
Phosphorus	P.	15·7	Uranium	U.	217
Platinum	Pl.	98·8	Yttrium	Y.	32·2
Potassium	K.	39·15	Zinc	Zn.	32·3
Rhodium	R.	52·2	Zirconium	Zr.	33·7

Chemical attraction is sometimes called *affinity*. When *two* bodies which have a chemical attraction for each other are mixed together and combine,—sulphuric acid and magnesia, for instance,—this is said to be a case of *simple affinity*.

Affinity is exerted with different degrees of force between different bodies—*i. e.*, some have far more mutual attraction than others. Thus sulphuric acid and ammonia attract each other more forcibly than carbonic acid and ammonia.

If, therefore, sulphuric acid be added to a combination of carbonic acid and ammonia, it seizes the ammonia, and expels the carbonic acid. This is said to be a case of *single elective affinity;—elective*, because the sulphuric acid is, as it were, *chosen* by the ammonia in preference to the carbonic. It is also said to be a case of simple *decomposition;* the *compound* of carbonic acid and ammonia being separated or decomposed by the sulphuric acid.

When two bodies, each composed of two others, are put together, there may occur what is called *double decomposition*, in consequence of *double elective* affinity. Thus, let there be mixed together one compound of iodine and potassium *(called iodide* of potassium) and another *of chlorine and mercury* (called bichloride of

mercury); here there occurs a double interchange; the chlorine passes from the mercury to the potassium, and the iodine from the potassium to the mercury.

It was said before, that chemical attraction takes place only at insensible distances; hence it is promoted by whatever tends to divide matter most minutely, and to bring its particles into closest contact; especially mechanical *division* and *solution*. It is opposed by whatever tends to harden bodies, or to remove them from each other.

Chemical action is generally evidenced by certain phenomena. *Heat* and *light* are very common attendants on rapid and energetic chemical action; *change of form*, from solid to liquid or aeriform, or the reverse, is also very common; but the most remarkable test of chemical action is the production of a *new compound*.

Hence the chemical combination of two bodies is very different from a mechanical mixture.

When two bodies are merely mixed mechanically, each retains its properties, although in a modified form. Thus brandy and water, or sulphuric acid and water, may be mixed in any proportions, but each ingredient still exhibits its distinctive qualities, although weakened or mitigated.

But when two bodies *combine chemically*, each loses its own properties, and a new body is formed quite unlike either of its constituents. Thus sulphuric acid and magnesia, when combined, form sulphate of magnesia, in which not a trace can be detected of either sulphuric acid or of magnesia, by sight, touch, smell, or taste.

The terms *Synthesis* and *Analysis* are frequently used in chemistry; the former denotes the combining or uniting of substances; the latter, their decomposition or separation. These terms, however, are only applicable when we decompose or unite substances *with the express intention* of finding their actual composition. Thus, if we decompose water by galvanism,

ıe evolution of oxygen and hydrogen at oppo-
, and again form water by exploding these
s, we are said to have examined that body
ally and analytically.

, heat, electricity, galvanism, and magnetism
se depending on the disturbance of chemical
on in peculiar manners; they are all intimately
together, and seem to depend on the various
gs of one common cause.

ATOMIC THEORY.

is supposed that all substances, solid, liquid, and
rm, consist of small particles or *atoms*, which are
able of further division.

ow whilst *mechanical mixtures* may be made in
st all proportions, it is found that *chemical com-
ition* can occur only between certain definite
ghts of the combining bodies.

Again, *some bodies unite in one proportion only*, as,
example, chlorine and hydrogen.

*Other bodies unite in several proportions: but these
portions are definite, and in the intermediate ones no
ibination ensues.* Thus, 14 parts of nitrogen com-
ıe with 8, 16, or 24 parts of oxygen, but with no
ermediate proportion.

When one body enters into combination with another
different proportions, the numbers indicating the
ater proportions are simple multiples of that de-
ting the smallest proportion. Thus the smallest pro-
rtion in which oxygen combines with any body is
noted by 8, its next is 16, the next 24, and so on;
d it will not unite in any intermediate propor-
ns.

Dalton first advanced the opinion, that combination
kes place between the atoms of bodies only. For
ample: one part by *weight* of hydrogen combines
th *eight by weight of oxygen*. He conceives that in

this quantity of hydrogen there are as many ultimate particles, or atoms, as there are in eight times that weight of oxygen, and that each atom of hydrogen combines with an atom of oxygen. He also believes, that in those cases where bodies unite in several proportions, one atom of one body is united with one, two, three, four, or a certain number of atoms of the other.

By establishing the relative weights of the atoms of bodies on this principle, most important data have been arrived at. If a quantity of hydrogen weighing 1, combines with and contains the same number of atoms as a quantity of oxygen weighing 8, it is evident that if an atom of hydrogen weigh 1, an atom of oxygen must weigh 8 times as much. According to this, therefore, the relative weights of the atoms of bodies, and their chemical equivalents, will be expressed by the same numbers.

LIGHT.

On the peculiar nature of light two theories exist, the *corpuscular* and *undulatory*.

The former, which is the theory of Newton, considers light to consist of extremely minute particles, too subtile to exhibit the properties of matter, yet really material, which emanate from all luminous bodies, travel with amazing velocity, and passing through the substance of the eye, strike on the retina, and cause the sensation of vision.

The latter hypothesis, which, prior to Newton's analysis, had been maintained by Huyghens, Descartes, and Hook, has since been supported with remarkable ability by Young. According to these philosophers, bodies are rendered luminous or visible by the undulations or vibrations which they excite in a particular fluid, and which are transmitted through it to the retina of the eye.

asons for considering light as a material sub-
re, that it can be reflected from the surface of
y to another, that it is emitted from bodies in
t distant regions of space, and that it passes
m to the earth independent of any medium.
, it is inflected near to bodies when it passes by
t inclines toward the perpendicular when it
rom a rarer to a denser medium: parallel rays
n a convex mirror are made to diverge; and,
n the contrary, they fall on a concave spherical
they converge so as to meet at a point situated
between the centre and the circumference of
le of which the mirror is a segment. This
called its *focus* for *parallel rays*, or its *princi-*
s.

philosophers now suppose that heat and light
e modifications of the same substance: but
pothesis is opposed by the facts, 1st, that the
s rays in the moonbeam have no calorifying
2nd, that rays of heat are intercepted by a
creen, while those of light are transmitted
; 3rd, the experiments of Herschel, which
ie existence of rays having different properties
unbeam.

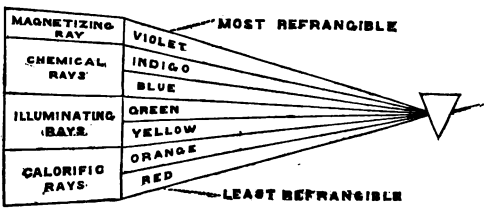
passes in straight lines through all transparent
provided no reflection occurs, and there is no
of density; but when it passes from a rarer to
r medium, the direction in which it moves is
less changed, unless it shall have entered that
perpendicularly. This change of the course or
n of light is termed its *refraction*.

ns who are said to be *long-sighted* are unable to
r objects distinctly, arising from a weak re-
power of the eye, owing to deficient convexity
ity of the humours of the eye. This kind of
s an infirmity of advanced life, and is to be
d by *convex glasses*. In *short-sighted* persons,
active power is so great, from too great con-

vexity, that all the rays which do not diverge rapidly are brought to a focus before they reach the retina. This is an affection which young people are liable to, and which is remedied by *concave glasses*.

A ray of light is a compound body, and its analysis may be effected either by refraction or absorption.

By refraction, Newton, who first discovered the compound nature of solar light, effected its decomposition. His mode of operating consisted in admitting a ray of light into a dark chamber, through a nearly closed window-shutter, so that it fell obliquely on a glass prism. By this means an oblong, coloured surface, composed of seven different tints, is produced. These colours are termed the *prismatic*, and are arranged in the following order:—



From this and other experiments Newton inferred that white light is a mixture of these seven colours, and that their separation depended on an original difference in their refrangibility, the violet being the most refrangible, and the red least so.

Bodies which allow of the transmission of light are clear and transparent; those which reflect it unchanged are white; and those which absorb all the *rays that fall* upon them are black. When a body *absorbs some of the* rays of light, and reflects the rest,

lways of that colour which is produced by the
ation or mixture of those rays which it reflects.
only one kind of ray is reflected, the reflecting
ice has the same colour as that ray.
ester has had recourse to several ingenious ex-
nts, which tend to prove that the seven colours
spectrum are produced by three primitive or
rays — namely, the red, yellow, and blue.
ays are concentrated in the spectrum, where the
y ray appears; but each extends more or less
e surface of the spectrum, the mixture of red
low giving orange; of yellow and blue, green; and
th blue and a little yellow, producing the violet.
maximum of illuminating power lies in the
st yellow or palest green; the latter is almost
r bright with the yellow; but beyond the deep
he illuminating power sensibly decreases.
ording to Herschel, when a delicate thermometer
ed a little beyond the red ray, there is evidence
greatest heat at that spot; and he found that
lower when removed towards the violet. In
inion, Davy, Englefield, and others have coin-
while Leslie and others have asserted that it is
red itself.

r light is capable of producing remarkable
al changes. Among these, the most striking
bleaching and deoxidizing powers. The latter
is well illustrated in the daguerreotype, in which
ide of silver is *reduced* by the solar light. This
posed to be produced by certain rays which have
inct action, termed *actinism* (from ἀκτίν, a
Without solar light, vegetables lose their green
and active qualities, and become pale, and
with a succulent cellular tissue. Gardeners
dvantage of this property for bleaching celery,
, &c. Animals also lose the red colour of their
and become weak and subject to tuberculous and
tic diseases

The violet ray was supposed, by Morrichini, to possess the property of rendering steel and iron magnetic. The experiments of Riess and Moser tend to subvert this theory.

The rays emanating from the sun move at the rate of 200,000 miles a second; the light from that source reaching the earth, a distance of 95 millions of miles, in 8¼ minutes.

The sources of what is termed *Terrestrial Light* are, bodies in a state of incandescence, phosphorescence, and illumination—the result of artificial means. The white light of incandescent charcoal, which is the chief source of light from candles, oils, &c., forms a good example of the last. Further, the dazzling light emitted from lime intensely heated gives the prismatic colours almost as bright as in the solar spectrum.

Construction of Leslie's photometer, to estimate the strength of the sun's light.—It consists of his differential thermometer, with one ball made of black glass, contained within a case of thin glass, the object of which is to prevent the balls from being affected by currents of cold air. The clear ball transmits all the light that falls upon it; its temperature, therefore, is not affected; on the contrary, it is absorbed by the black ball, and by heating the air within causes the liquid to rise in the opposite stem. The action of this photometer depends on the absorption of the calorific rays by which light is accompanied.

A number of bodies, both liquid and solid, transparent and opaque, are found to effect a remarkable change in light of certain refrangibility and colour. A dilute solution of sulphate of quinine, for instance, changes the violet and the dark blue light to sky blue; a decoction of madder in a solution of alum will convert rays of higher refrangibility than yellow *into yellow;* by an alcholic solution of the colouring *matter of leaves,* all the rays of the spectrum become red.

Polarization of Light.—A ray of light made to pass

through certain crystals becomes split or divided into two rays, one of which follows the general law of refraction, and the other takes a different course, according to the position of the crystal. This effect, which is called double refraction, is beautifully illustrated in the case of Iceland spar or crystallized carbonate of lime.

Again, if a ray of light be suffered to fall on a plate of glass at an angle of 56° 45′ the portion of the ray which suffers reflection will be found to have acquired properties which it did not before possess; for on throwing it under the same angle upon a second glass plate, it will be seen that there are two particular positions of the latter in which the ray ceases to be reflected. Light which has suffered this change is said to be *polarised*.

HEAT, OR CALORIC,

Is that power, or substance, which, when applied to the human body, excites the sensation of heat. It causes bodies to expand, and to pass from a solid to a liquid, and from a liquid to a gaseous form. It causes all the changes which are indicated by the thermometer; it is present in all material substances; it is imponderable and invisible; and its evolution along with light constitutes the phenomena of combustion.

The term "Caloric" has been applied to the *matter* of heat, and by *heat* has been understood the *sensation* produced by caloric. But although we speak of caloric as a *substance*, for convenience sake, it is probably only a *property* of matter, depending on extremely rapid and subtle vibrations.

Caloric may exist in two different states—in a state of freedom (*sensible, or free caloric*), or in a state of combination (*latent, or combined caloric*).

Caloric is communicated from a hot body to others which are colder, in two ways, by *conduction*, and by

radiation: by the former, when a hot body touches a cold one, so that the heat travels along directly from one to the other; by the latter, when the heat passes off from the heated body to others at a distance. Both conduction and radiation depend on the tendency caloric has to diffuse itself among all bodies, until an *equilibrium of temperature is established.*

When a red-hot ball is suspended in the air, rays of heat, which move with excessive rapidity in straight lines, emanate from it in every direction. This is an example of the *radiation of caloric.* Caloric can only be radiated through gasses or in vacuo.

Caloric passes through different bodies with different degrees of velocity, some substances offering very little impediment to its progress, while others transmit it slowly. Owing to these facts, bodies have been divided into *conductors* and *non-conductors* of heat.

Metals are the best conductors of heat; and the relative conducting power of these and some other substances is given in the subjoined list, which has been founded on the experiments of Despretz:—

Gold	1000	Tin	303·9
Silver	973	Lead	179·6
Copper	898·2	Marble	23·6
Platinum	381	Porcelain	12·2
Iron	374·3	Fine Clay	11·4
Zinc	363		

Liquids are but imperfect *conductors* of caloric, in the strict sense of the term, although they are capable of transmitting it very rapidly through their particles. When heat is applied to the under surface of a vessel containing water, two currents are immediately established in the liquid; the one, of hot particles, rapidly rising towards the surface, the other, of colder particles, descending to the bottom. This transmission *of hot particles* is termed the *convection* of heat. *When the heat is* made to enter at the upper surface

of the vessel, it is so slowly transmitted to the lower strata of liquid, that Count Rumford denied that water was capable of conducting heat. Yet the experiments of Hope, Thomson, and the late Dr. Murray, show that water is capable of conducting caloric, though in a very slight degree.

Take a long glass tube filled with water, and you may boil the water in the upper part of it by means of a spirit-lamp, whilst the bottom continues quite cold; but if you apply the lamp to the bottom of the tube, the heated water rises to the top, and makes the whole warm. Thus is seen the difference between *conduction* and *convection;* the particles of a conductor—an iron poker, for instance—allow the heat to travel through them; whilst the particles of a column of water, or air, shift their place, and *convey* the heat with them.

The conducting power of aeriform fluids is very imperfect, even more so than liquids. Berthollet, however, advanced the opinion that gases are extremely good conductors.

The solid bodies that are the worst conductors of caloric are, wood, charcoal, fur, hair, feathers, cotton, wool, and all substances of a light, porous texture; but their non-conducting properties are probably owing to the air which they contain in their pores.

RADIATION OF HEAT.—The great source of *radiant caloric* is the sun, which is continually radiating an immense quantity of caloric upon the earth.

Caloric is emitted from the surface of a hot body equally in every direction, and in right lines, like radii drawn from the centre to the surface of a sphere. When the rays thus emitted fall on a solid or liquid substance, they may be disposed of in three different ways:—

1. They may be *reflected;* 2, they may be *absorbed;* and, 3, they may be *transmitted* through it.

In *the first and third cases,* the temperature of the

body on which the rays fall is not affected; whereas in the second it becomes materially so.

The radiation of heat by hot bodies is influenced in a very marked degree by the nature and colour of their surfaces. To demonstrate this by experiment, let a canister of polished block tin, forming a cube of six or eight inches, be provided, having an orifice at the middle of its upper side, from half an inch to an inch in diameter, and the same in height. This orifice is intended to receive a cap having a small hole, through which a thermometer is inserted, so that its bulb may reach the centre of the canister. Let one side of the canister be covered with black paint; by scratching with sand-paper, destroy the polish of another side; tarnish a third with quicksilver; and leave the fourth bright. The vessel is now to be filled with boiling water. The radiation of caloric is greatest from the blackened side, less from the tarnished or scratched side, and least of all from the polished side.

A bright, smooth, polished plate of metal radiates very imperfectly; but if its surface is in the slightest degree dull or rough, the radiating power becomes augmented. It follows from this, that the velocity and power of radiation depends more on the *surface* than the *substance* of a radiating body. Polished gold, silver, tin, brass, &c., are bad radiators of heat; but the same metals become good radiators if their polish and smoothness become destroyed.

Those surfaces that reflect *light* most perfectly are not equally adapted to the reflection of *caloric*. For example: a glass mirror, which reflects light with great effect, when held before a blazing fire scarcely returns any heat, and the mirror itself becomes warm. On the contrary, a polished plate of silver, tin, or brass—metals which are little prone to receive heat *from* other sources, but which retain their own heat—*reflects to the* hand a very considerable degree of *warmth*. *Thus* it is proved that metals are much

better reflectors of caloric than glass, and that they possess this property in a higher degree in proportion to the perfection with which they are polished.

The best reflectors of caloric will *absorb* the least heat; or in other words, surfaces are endowed with various powers of reflecting caloric, and their power of absorbing caloric is in the inverse ratio of their reflecting power. Those surfaces that radiate best, also absorb heat most readily.

MEASUREMENT OF HEAT.—*Fahrenheit's Thermometer.*—The above instrument is the one generally employed in this country. The first object in constructing this instrument is to obtain a glass tube with a very small bore, which is of the same diameter through its whole length. On one end of the tube let the neck of an elastic bottle be firmly tied, and let the other end be heated by the flame of a blowpipe until the glass softens. The softened part must then be pressed, by a clean piece of metal, into the form of a rounded button, and to this the flame of a lamp should be steadily applied till it acquires a white heat, and seems about to enter into fusion. To prevent its falling on one side, the tube during this time must be constantly turned round by the hand. When the heated part appears quite soft, remove it quickly from the lamp, and, holding the tube vertically, with the elastic bottle uppermost, press the latter gently with the hand. By this means a bulb will be formed. Mercury is now introduced by rarefying the air in the bulb by means of heat, and then dipping the open end of the tube into a saucer of clean quicksilver. As the air cools and contracts, the mercury is forced up, and, entering the bulb, supplies the place of the air which has been expelled from it. A portion of air, however, remains, which is expelled by boiling the mercury. The bulb and one-third of the tube being full of the mercury, the next step is to seal the open end *hermetically. This is* done by heating the mer

cury till it completely comes up to the top of the tube, and then darting a fierce flame across the latter, to melt it and seal it up. Thus the tube is closed, and air quite excluded.

The next stage of the process is to graduate the instrument; and in order to effect this, the first step consists in taking two fixed points. The freezing point of water is ascertained by immersing, in melting snow or ice, the bulb and part of the stem; so that the mercury, when stationary, shall barely appear above the surface. At this point a mark should be made with a file. In order to ascertain the boiling point much more precaution is requisite. The directions generally given are, that the water be perfectly pure, free from foreign bodies, and not above an inch in depth, the ebullition brisk, and conducted in a deep metallic vessel, so that the stem of the thermometer may be surrounded by an atmosphere of steam, that the vapour be allowed to escape freely, and that the barometer stand at thirty inches. Having obtained the boiling point, another mark is to be made. The intermediate space between these two points, the lowest being called 32°, and the highest 212°, is to be divided into 180°.

Continental philosophers employ either the centigrade or Reaumur's scale. The centigrade is the most convenient in practice; its boiling point is 100, that of melting ice its zero, and the interval is divided into 100 equal parts. The space in Reaumur's is divided into 80 parts.

Very high temperatures are measured by instruments called *pyrometers*. The pyrometer which was formerly in general use was constructed by the late Mr. Wedgewood. Its invention was founded on the principle, that clay progressively contracts in its dimensions as it is gradually exposed to higher degrees of heat. He formed his white porcelain clay into small cylindrical pieces, in a mould, which, when they

were baked in a dull red heat, just fitted into the opening of two brass bars, fixed to a brass plate, so as to form a tapering space between them. This space is graduated; and the further the pyrometric clay gauge can enter, the greater heat does it indicate. The two converging rules are placed at a distance of 0·5 of an inch at the commencement of the scale, and of 0·3 at the end. This scale commences at a red heat, visible in daylight; and he estimated that this corresponds with 1077 of Fahrenheit's scale, and that each degree of his pyrometer is equal to 130 degrees of Fahrenheit's thermometer.

The pyrometer which is now supposed to be capable of the most precision is Daniell's. This instrument consists of two parts, the *register* and *scale*; the former designed for exposure to the heat to be estimated, and the latter, for measuring the exact amount of expansion. The first consists of a bar of black-lead earthenware, in which is drilled a hole 3-10ths of an inch in diameter, and 7½ inches deep. Into this hole a cylindrical bar of platinum, or soft iron, of nearly the same diameter, and 6½ inches long, is introduced, so as to rest against the solid end of the hole; and upon the outer or free end of the metallic bar rests a cylindrical piece of porcelain, called the index, 1½ inch long, and retained firmly in its place by a strap of platinum and a little wedge of earthenware. The object of this arrangement is, that when the register is heated, the metal, expanding at each temperature more than the earthenware case, presses forwards the index; and as this last moves with friction, in consequence of the strap and wedge, it remains in its place when the register is removed from the fire and cooled. The scale is the portion of the instrument designed for measuring with minute accuracy the precise extent to which the index is pushed forward by the expansion of the metallic bar.

LATENT *HEAT.*—*When* heat is applied to any solid

or fluid, and raises its temperature, as ascertaine the thermometer, it is called *sensible* heat. But u some circumstances, although heat is continued t applied, yet the substance does not become hotter; and the heat is said therefore to be *latent.*

But there is one phenomenon which always oc when heat becomes latent; and that is, that the stance so heated changes its form, either from sol liquid, or from liquid to aeriform. For instance pounded ice into a vessel; and the thermometer stand at 32°. Add heat, and the thermometer continue at that point; *but the ice melts;* and t is all melted the water does not rise above 32°. put an equal quantity of water at 32° into a sm vessel, and apply heat; then it will be found tha same heat which becomes *latent* in melting the will raise an equal quantity of water to 172°; th to say, exactly 140° become latent in melting ice. In the same way, when water boils, the does not raise the water above 212°, but it bec latent in the steam. In fact, steam of 212° d from water at 212° in containing 950° of latent

Specific heat.—This term signifies that different stances have their temperatures raised unequall the same degree of heat. In fact, the same amou heat which would raise water one degree, would oil 2°, and mercury 23°.

Frigorific mixtures.—When bodies expand, quefy, or evaporate, heat is absorbed or made la i. e., cold is produced. When, on the contrary pour is condensed into a liquid, or a liquid into a heat is given out. Advantage is taken of these ciples in forming mixtures for the purpose of ducing cold. These may be formed of ice, or *and salt,* or snow and dilute sulphuric acid, or a *ture of neutral salts* with water; and it is found *the ice or salt in* dissolving absorbs considerable

i. e., generates considerable cold. Two parts of ice pounded to one of salt, or equal weights of saltpetre and sal-ammoniac, with water enough to dissolve them, are useful mixtures.

EFFECTS OF HEAT.—The general effects of heat are, expansion, liquefaction, vaporization, spontaneous evaporation, and ignition.

Expansion.—The bulk of all bodies is increased when their temperature is augmented, and this is supposed to be owing to the caloric insinuating itself between the particles of the substance, and thus separating them more or less from each other. The degree of expansion is in the direct ratio of the increase of temperature, and the expanded body returns to its former size when its temperature is reduced.

The ratio of expansion is greatest in gases, next in liquids, and least in dense bodies.

Exceptions.—Water in passing from 39° or 39·5° to 32° expands. The other liquids which expand under diminution of temperature are, fused iron, zinc, antimony, and bismuth. This expansion, however, is said to be owing to the particles of the liquid arranging themselves in a new form when about to become solid. Alumina is also stated to be a remarkable exception to the law that caloric expands bodies.

Liquefaction.—Almost all solids are capable of being liquefied when their temperature is sufficiently increased. It is supposed that the caloric acts by diminishing the cohesion of their particles, and thus allowing them to move freely on each other.

Ebullition.—This term is used to denote the rapid conversion of a liquid into an aëriform state, as when water is converted into steam by boiling it. The degree at which liquids boil depends on the atmospheric pressure on their surface. Water, on high mountains, where the weight of the atmosphere is little, boils at a very *low degree; in fact,* the boiling point sinks *one degree for every 530 feet* of ascent. Increase the

pressure on the surface of the liquid, however, and the liquid may be heated to any degree without boiling.

Spontaneous evaporation.—Many liquids, and indeed solids, readily pass into the state of vapour, or volatilize, at the common temperature. Alcohol, ether, and water, form examples of the former; while carbonate of ammonia, iodine, and bromine, may be adduced as those of the latter.

Ignition.—When a substance is exposed to a sufficient heat to cause it to become luminous, and at the same time to radiate caloric, without undergoing any marked chemical change, it is said to be in a state of ignition. Wedgewood fixed the point at which this takes place at 947, and Dr. Irvine placed it between 672 and 790.

The sources of heat are generally reduced to six: 1, the sun; 2, combustion; 3, electricity; 4, animal heat; 5, chemical action; 6, mechanical action; combustion and animal heat may both be ranked, however, under the head of chemical action.

ELECTRICITY.

When a glass rod is rubbed with a silk handkerchief, it at first attracts, and then repels, bits of paper, or cotton, feathers, or gold leaf. The principle thus brought into action is called electricity, from the Greek word, ηλεκτρον, amber, because the electric property was first excited in this substance.

The phenomena of electricity are strikingly produced by an *electrical machine*, which consists, essentially, of a glass cylinder, fixed upon an axis, and pressed by a *cushion* or *rubber*, which is generally besmeared with a soft compound of an amalgam of mercury and tin mixed with grease. At a short distance is placed a metallic cylinder, supported by glass feet, called the *prime conductor*, which at the end next the

glass cylinder, has commonly a few projecting teeth, made of pointed wire. The rubber being connected by a small chain, or other means, with the table or floor, and the glass cylinder made to revolve upon its axis, a crackling noise is heard, attended with a luminous appearance, and on bringing the knuckle of a finger, or a metallic knob, near the prime conductor, a spark issues, accompanied by a slight report, and if the knuckle has been applied, with a pricking sensation. In this case the glass is said to be *excited*, and the prime conductor to be *charged* with electricity.

If, while the prime conductor is charged, two gilt pith balls, suspended by fine silken threads, and in contact with each other, are approximated to the conductor, they immediately fly asunder, but on being moved away they again fall together. Now these two balls, under the above circumstances, being in the sphere of the same influence, may be considered as in the same state of electricity; and hence *bodies similarly electrified are said to repel each other*. Instead, however, of connecting the rubber with the floor, connect it with a second prime conductor, and let a wire be attached to each conductor, from which the balls may hang separately, each by its thread, with a small space intevening between them. The balls will now attract each other, and come into apposition. *Bodies, therefore, dissimilarly electrified, attract each other.*.

Bodies are said to exist in two states of electricity: those containing a large quantity, or *plus*, of electricity, are said to be *positively electrified*: on the contrary, those which contain a small proportion, or *minus*, of this fluid, are said to be *negatively electrified*. Hence the terms *positive* and *negative* electrics, the former corresponding to the *vitreous* and the latter to the *resinous* electrics of Dufay.

Franklin accounts for the phenomena of electricity by supposing that *there is one fluid* only, equally subtile *with caloric and light*, an excess of which causes

the state of *positive*, and its deficiency that of *negative*. This theory has been supported by Æpinus, Cavendish, &c.

Electricity passes over the surface of some substances with great ease and rapidity, and over others slowly and with difficulty; hence bodies are divided into *conductors* and *non-conductors* of electricity. The following substances conduct electricity rapidly, and those at the head of the list possess a *conducting* power greater than that of water, in the proportion of three millions to one:—copper, silver, gold, iron, tin, lead, zinc, platinum, charcoal, plumbago, strong acids, soot and lamp black, metallic ores, metallic oxides, dilute acids, saline solutions, animal fluids, sea water, water, ice and snow above 0°, living vegetables, living animals, flame, smoke, vapour, salts, rarefied air, dry earth, massive minerals.

The following is a list of *non-conductors* of electricity, in the order of their insulating power: shellac, amber, resins, sulphur, wax, asphaltum, glass, and all vitrified bodies, raw silk, bleached silk, dyed silk, wool, hair, feathers, dry gases, dry paper, parchment, and leather, baked wood, and dried vegetables, porcelain, marble, massive minerals (non-metallic), camphor, caoutchouc, lycopodium, dry chalk, and lime, phosphorus, ice below 0° of Fahr., oils, the densest of which are best, dry metallic oxides, including fused alkaline and earthy hydrates.

Such bodies as are capable of being excited by friction are called *electrics;* and among these the principal are, glass, sulphur, wax, resins, amber, precious stones, silk, &c., which are above shown to be *non-conductors*. The *conductors* are also called *non-electrics*, because they cannot be excited by friction without very particular management.

A non-electric, supported by a non-conductor, is said *to be insulated;* and in this state the insulated body *is capable of retaining* its charge of electricity for a

considerable time, provided the atmosphere be in its ordinary state of dryness and density. When it is intended to collect a quantity of electricity, so that a powerful charge may be accumulated, the *Leyden jar* is generally employed. This is a glass jar, which is lined internally, and coated externally, to a certain height, with tin foil, and closed at the top with a cork, through the middle of which there passes a brass rod; a brass chain is attached to the end of this rod, which is within the jar, extending down and resting on the metallic lining, while the other end, which is without the jar, terminates in a small ball of the same metal. When this metallic ball is placed in contact with the prime conductor of an excited electrical machine, while the outer coating communicates with the ground, the interior of the jar acquires a charge of positive electricity, and the exterior becomes as strongly negative. In order to discharge the Leyden jar, one end of a conducting substance should be applied to the brass ball, and the other end to the external coating of the jar: the moment this communication is established between these two parts, the internal metallic lining gives off its excess of electricity to the external metallic coating, the two fluids rush together with violence, and thus the electric equilibrium is restored.

The instrument generally used to measure the intensity of electricity in any body is termed an *electrometer*. Of these, various kinds have been constructed by different chemists, from pith, gold leaf, &c.

The phenomena of thunder and lightning depend on electricity, and are produced by the clouds becoming positively electrified, and discharging their electricity upon the earth, or *vice versâ*.

GALVANISM is similar in its phenomena to electricity and electro-magnetism. Although the effects of electricity *in inducing* and destroying magnetism *were long known from* the action of lightning on

knives, forks, the compass needle, &c., we are indebted to Professor Oersted and M. Ampère for an analysis of the laws which regulate these phenomena, for explanation of which we must refer to larger treatises on chemistry. Galvanism owes its name and origin to the experiments on animal irritability made by Galvani in the year 1790. He imagined that animal electricity originates in the brain, is distributed to every part of the system, and particularly resides in the muscles. Further, he believed that the galvanic phenomena are owing to the electricity in the muscles, and that the metals only serve the purpose of conductors.

Volta was the first who succeeded in demonstrating the fallacy of the experiments of Galvani. He maintained that electric excitement is due solely to the metals, and that the muscular contractions are occasioned by the electricity thus developed passing along the nerves and muscles of the animal. To this distinguished philosopher belongs the real merit of laying the foundation of the science of galvanism.

Galvanism is more powerful than the electricity produced by the common electrical machine. The effects of common electricity are caused by a comparatively small quantity of that fluid brought into a state of insulation, in which case it exerts a high intensity, as evinced by its remarkably attractive and repulsive powers, and by its being capable of forcing its passage through obstructing media. In galvanism, although the electric agent is developed in large quantity, it never attains a high tension. It cannot pass through the air to any distance; the opposite wires must be brought into contact before the positive and negative electricities neutralize each other.

The most powerful mode of obtaining electricity has been recently discovered in the jet of steam from the steam-pipe, and which is referred by Faraday and others to the friction of condensed water against the

exit tube. The steam is usually positive when the tube is made of wood or clean metal, but the least trace of fatty matter changes the character.

OXYGEN.—*Preparation.*—Oxygen gas is most commonly obtained from the peroxides of manganese, lead, and mercury, and the nitrate and chlorate of potash. It may also be obtained by exposing the green leaves of vegetables to the solar light, in a jar filled with water. By heating the peroxide of manganese to a red heat, in an iron bottle, every two atoms of the peroxide yield one of oxygen, and two eq. of the sesquioxide remain. On adding a little more than its own weight of sulphuric acid to peroxide of manganese, and applying heat, one atom of the oxygen of the peroxide is evolved, and a protosulphate of manganese remains. By exposing pure peroxide of mercury to heat, all its oxygen is driven off.

On exposing the chlorate of potassa to a high heat, the oxygen both of the chloric acid and the potash is driven off, and the chlorine combines with the potassium, forming chloride of potassium, which is the sole residue of the process.

CHLORATE OF POTASSA.

1 Chloric Acid = 1 Chlorine, 5 Oxygen
1 Potassa = 1 Potassium, 1 Oxygen
} yield {
1 Chloride of Potass = 1 Chl. 1 Potassium.
6 Oxygen.

Properties.—Colourless, tasteless, inodorous; feeble refractor of light; non-conductor of electricity; heavier than atmospheric air, sp. gr. being estimated at 1·1026 by Dulong and Berzelius, so that 100 cubic inches weigh, at 60° and 30′ bar. 34·193 grains. It is the chief supporter of combustion and respiration, and forms one-fifth of the atmosphere, and eight-ninths of the water, of the globe. Its combining proportion is 8. It is *sparingly absorbed* by water, and evolves both *heat and light when* suddenly compressed. It com-

bines with metals, forming oxides, acids, alkalies, and earths. Its name, derived from the Greek words, ὀξὺς, *acid*, and γεννάειν, to *generate*, was proposed by Lavoisier, who considered it the sole cause of acidity.

Whenever common *combustion* takes place, oxygen gas disappears, and a new compound, consisting of oxygen and the combustible, is generated. The term *combustion*, therefore, in its common acceptance, implies the rapid union of oxygen gas and combustible matter, accompanied with heat and light.

HYDROGEN.—*Preparation.*—This gas may be obtained by the action of diluted sulphuric acid on zinc or iron. It may also be obtained by the gun-barrel process. The action of diluted sulphuric acid on zinc and iron is described under the heads FERRI SULPHAS, ZINCI SULPHAS.

The gun-barrel process consists in passing the vapour of water over bright iron wire, or turnings, heated to redness. For this purpose these are put into an iron tube, or gun-barrel, about eighteen inches or two feet long, open at both ends, and made to traverse a furnace. A retort, containing water, is attached to one end of the gun-barrel: a bent brass tube, with an iron head, is well fitted to the other end. When the gun-barrel is at a red heat, the water in the retort is made to boil, and the steam passing over the iron is immediately decomposed; its oxygen combines with the iron, forming oxide of iron; its hydrogen escapes in a gaseous form, and passes through the bent tube. Nine parts of water require 28 of iron for their decomposition, 36 parts of oxide of iron being formed, and 1 of hydrogen being evolved.

Properties. — Colourless, inodorous, tasteless; a powerful refractor of light; always gaseous when *uncombined. It is a* non-supporter of combustion or *respiration, but it is* highly combustible. Hydrogen *is distinguished from* all other substances by its small

combining proportion, and by its being the lightest of all known bodies which possess weight. As generally prepared, it has a faint, disagreeable odour, which, however, depends on impurities. Its equivalent by weight is 1, its sp. gr. 0·06896; weight of 100 cubic inches 2·1371 grains.

Oxygen combines with hydrogen in two proportions, forming protoxide of hydrogen (water), and a peroxide or binoxide (oxygenated water).

WATER.—When a mixture of two volumes of hydrogen and one of oxygen is ignited by electricity, or by flame, violent explosion immediately ensues, and water is formed. This fluid is composed of—

	By Weight.	By Volume.
Oxygen . .	. 8	 1
Hydrogen . .	. 1	 2
Equivalent . .	. 9	 3

Common water always contains impurities, which render it unfit for medicinal uses, and from which it may be purified by distillation. *Spring water*, which is the purest, with the exception of that obtained from melting snow or rain water, contains a little carbonate of lime, and chlorides of calcium and sodium; *river water* contains sulphate and carbonate of lime, and chloride of sodium; and *well water* contains sulphate and carbonate of lime in larger quantity.

During the distillation of water the ammonia not unfrequently contained in common water, from the putrefaction of animal matter, together with the atmospheric air, oxygen, carbonic acid, and other volatile ingredients, passes over with the first portion, which is therefore rejected; and the fixed and saline impurities, which are generally the salts of lime, magnesia, soda, alumina, and iron, and the alkaline salts of native vegetables, *are left in* the retort, or still.

Pure distilled water ought not to undergo any

change on the addition of nitrate of silver, chloride of barium, oxalate of ammonia, protosulphate of iron, an alcoholic solution of soap, or an infusion of litmus, or blue cabbage.

NITROGEN, or AZOTE, from *a*, *non*, and *ζωή*, *vita*.—*Preparation*.—1. By burning a piece of phosphorus in atmospheric air, included in a jar or bell-glass over water. The phosphorus combines with the oxygen of the air, forming metaphosphoric acid, which is rapidly absorbed by the water, and the nitrogen, with a little carbonic acid and vapour of phosphorus, remains. These impurities may be removed by agitating the gas briskly with a solution of pure potash.

2. By exposing a mixture of fresh muscle and nitric acid, sp. gr. 1·20, to a gentle temperature. A large proportion of nitrogen with a little carbonic acid is evolved; the latter may be removed by agitation with lime water.

Properties.—Colourless, insipid, and inodorous. It is incombustible, and is incapable of either supporting combustion or respiration. It forms about four-fifths of the atmospheric air, and exists in almost all the products of the animal kingdom, and in those of the vegetable kingdom, which have active properties either as nourishment or poison. Its combining proportion is 14·15, sp. gr. 0·9722; 100 cubic inches weigh 30·166 grains.

It forms acids with oxygen; an alkali with hydrogen; and a peculiar substance having the properties of a simple body (cyanogen) with carbon.

The chemical compounds of nitrogen and oxygen are:—

	By Volume.		By Weight.		
	Nit.	Oxy.	Nit.	Oxy.	Equiv.
Nitrous oxide ...	100	50	14·15	+ 8	= 22·15
Nitric oxide.....	100	100	14·15	+ 16	= 30·15
Hyponitrous acid	100	150	14·15	+ 24	= 38·15
Nitrous acid.....	100	200	14·15	+ 32	= 46·15
Nitric acid	100	250	14·15	+ 40	= 54·15

ATMOSPHERIC AIR.—The earth is everywhere surrounded by a mass of gaseous matter, called the atmosphere, which is retained at its surface by the force of gravity, and revolves together with it around the sun. It is colourless and invisible, has neither taste nor smell when pure, and is not sensible to the touch unless when it is in motion. Its sp. gr. is reckoned 1, being taken as the standard of comparison for estimating the sp. gr. of all other gases. Weight of 100 cubic inches 31·0117 grains. At 62° it is 815 times lighter than water. Its pressure at the level of the sea is equal to a weight of about 15 pounds on every square inch of surface, and is capable of supporting a column of mercury 30 inches high, and one of water of 34 feet.

The construction of the *barometer* is founded on the fact that the atmosphere, supposing its density to be uniform, is capable of supporting in a glass tube a column of mercury 30 inches high, at the level of the sea. Owing to causes not at present understood, the pressure of the atmosphere varies at the same place; hence the indications of the barometer as a weather-glass; for it has been well ascertained, that when the weather is fair and calm the barometer is high, and when wet and stormy the mercury falls. Atmospheric pressure diminishes as we rise above the level of the sea, and on this principle the altitude of mountains is estimated; a fall of one inch in the barometer corresponds to 11,065 inches, or 922 feet of air.

From calculations founded on the phenomena of refraction, the height of the atmosphere is supposed to be about 45 miles; and Wollaston estimated, from the law of expansion of gases, that it must extend to at least 40 miles with properties unimpaired by rarefaction.

Composition:—By weight, nit. 79; ox. 21 = 100. By volume, *nit. 4-5ths; ox. 1-5th.*

The atmosphere also contains aqueous vapour and

carbonic acid, the latter in the proportion of 1 part in 100. The odoriferous matter of flowers, ammonia, and other volatile substances, are also frequently present.

Carbonic acid has been found in the atmosphere at all altitudes yet attained; its proportion is greater in summer than in winter, and its relative quantity is diminished after much rain, owing, perhaps, to the direct absorption of it by the moist ground.

The chief vital and chemical properties of the atmosphere are dependent on the oxygen which it contains. The uses of the nitrogen have not been ascertained, but it has been generally supposed to act as a mere diluent to the oxygen. The atmosphere is a mere mechanical mixture of its constituents, and not a chemical combination.

NITROUS OXIDE.—*Preparation.*—Nitrous oxide, or protoxide of nitrogen, is obtained by exposing the nitrate of ammonia to heat in a glass retort. The three eq. of hydrogen in the ammonia combine with three atoms of oxygen from the nitric acid, forming three atoms of water; the remaining equivalents of oxygen come away with the nitrogen, both of the nitric acid and the ammonia, in the form of nitrous oxide.

NITRATE OF AMMONIA.

$$\left.\begin{matrix}1\text{ Nitric Acid} = 1\,N\,5\,O\\ 1\text{ Ammonia} = 1\,N\,3\,H\end{matrix}\right\}\text{ yield }\left\{\begin{matrix}2\text{ Nitrous Oxide } 2\,N\,2\,O\\ 3\text{ Water .....} \quad 3\,H\,3\,O\end{matrix}\right.$$

Properties.—Colourless, slightly agreeable odour, and sweetish taste; sp. gr. 1·5241; 100 cubic inches weigh 47·22 grs. Water absorbs more than one-half its bulk of this gas. Most substances burn in it with much greater energy than in atmospheric air.

Sir H. Davy discovered that this gas is capable of *supporting* respiration for a few minutes. A few deep *inspirations of* this gas are followed by remarkable *feelings of excitement*, similar to the earlier stages of

intoxication; there is a strong propensity to laughter, and an unusual disposition to muscular exertion. This state of excitation is not accompanied by any subsequent depression, as in the case of other stimuli.

NITRIC OXIDE, NITROUS GAS, OR BINOXIDE OF NITROGEN.—*Preparation.*—By the action of nitric acid on copper this gas may be procured. The changes which occur are—one portion of nitric acid is decomposed, part of its oxygen oxidizes the copper, while another portion of it is retained by the nitrogen of the nitric acid, forming nitric oxide, which rises as gas. The oxide of copper thus formed combines with some undecomposed nitric acid, forming the blue nitrate of copper.

Properties.—Colourless, tasteless, inodorous; excites violent spasm of the glottis when an attempt is made to inhale it; sp. gr. = 1·0377, and 100 cubic inches weigh 32·137 grains. It has no action on test paper; but if any free oxygen or atmospheric air is present, it produces ruddy fumes, called *nitrous acid vapours*. This gas consequently forms a good test for the presence of oxygen; and again, oxygen forms a means of detecting the presence of nitric oxide.

It is not necessary to give distinct notices of hyponitrous and nitrous acids; nitric acid will be given under the article ACIDS, in the pharmaceutical section of this work.

CARBON.—Carbon is a simple elementary non-metallic body, occurring pure and crystallized in the form of the diamond, a mineral which is supposed to be derived from the slow decomposition of vegetable matter, and in the form of graphite or plumbago.

When wood is exposed to heat in close vessels the volatile parts fly off, and leave behind a black, porous substance, which is charcoal. If this be suffered to undergo combustion in oxygen, or with atmospheric air, the greater part of it will combine with the oxygen, and escape in the form of gas, leaving about a two-

hundredth part, which consists chiefly of saline and metallic substances. This pure, inflammable part of the charcoal is what is commonly called *carbon*.

Common charcoal is made from wood; coke is the charcoal from coal; ivory black, or animal charcoal, is that from bones; lamp black that from resin. The purest carbon for chemical purposes is obtained by strongly igniting lamp black in a covered crucible. This yields, like the diamond, unmixed carbonic acid by combustion in oxygen.

The compounds of carbon and oxygen are—

	Carbon.	Oxygen.	Equiv.
Carbonic oxide	6 or 1 eq.	8 or 1 eq.	= 14
Oxalic acid	12 or 2 eq.	24 or 3 eq.	= 36
Carbonic acid	6 or 1 eq.	16 or 2 eq.	= 22

CARBONIC OXIDE (C O).—*Preparation.*—By transmitting carbonic acid gas over red-hot fragments of charcoal contained in a tube of iron or porcelain. In this case, the carbonic acid takes up an additional portion of carbon. It may also be procured by decomposing oxalic acid by means of strong sulphuric acid.

Properties.—A colourless, inodorous gas; sp. gr. = 0·9727, and 100 cubic inches weigh 30·207 grains; has neither acid nor alkaline properties; is sparingly dissolved by water, and does not render lime-water turbid; it is inflammable, burning in atmospheric air with a blue lambent flame, and being converted into carbonic acid gas. It cannot support respiration.

OXALIC ACID (HO, C_2 O_3). — *Preparation.* — To six ounces of nitric acid in a stoppered retort, add, by degrees, one ounce of lump sugar, coarsely powdered, or of starch. A gentle heat may be applied during the solution, and nitric oxide will be evolved in large *quantity*. When the whole of the sugar is dissolved, *distil off* a part of the acid, till what remains in the *retort has a syrupy* consistence; this will form regular

crystals, amounting to 58 parts from 100 of sugar. These crystals must be dissolved in water, recrystallized, and dried on blotting paper.

Woody fibre, and many other organic substances, yield oxalic acid by the same process; it may also be procured by heating wood or other organic substances with caustic potass or soda.

This acid is found in many plants, especially in the *oxalis acetosella*, in which it exists in combination with potass; and it exists pure in the *chick pea*, or *cicer arietinum*. Many lichens also contain nearly one-half their weight of oxalate of lime, a substance which is to these plants what carbonate of lime is to corallines, and phosphate of lime to animal bones.

When heated with sulphuric acid, it is decomposed, and converted into equal volumes of carbonic acid and carbonic oxide.

Oxalic acid crystallizes in quadrilateral prisms, the sides of which are alternately broad and narrow, and summits dihedral, or if crystallized rapidly, in small irregular needles. They are efflorescent in dry air, but attract a little humidity if it be damp; are soluble in one part of hot and two of cold water; and are decomposed by a red heat. Their acidity is so great, that when dissolved in 36,000 times their weight of water, the solution reddens litmus paper, and is perceptibly acid to the taste. It is a strong poison. The antidote is chalk or magnesia.

CARBONIC ACID ($C O_2$).—*Preparation.*—By the action of diluted hydrochloric acid on fragments of marble, when carbonic acid escapes, and chloride of calcium is left in solution.

Properties.—Colourless and inodorous; sp. gr. 1·524; extinguishes flame; highly destructive to animal life. When an attempt is made to inspire pure carbonic acid, violent spasm of the glottis takes place, which prevents the gas entering the lungs. If it be so much diluted with air as to admit of its

passing the glottis, it then acts as a narcotic poison on the system.

The agreeable pungent taste of beer, porter, and ale, is owing to the presence of carbonic acid, by the loss of which, on exposure to the air, they become stale. All kinds of spring and well water contain carbonic acid, to which their flavour is chiefly owing. The insipid taste of boiled water is owing to the absence of carbonic acid.

Carbonic acid is always present in the atmosphere, even at the summit of the highest mountains. The well-known tendency of gases to diffuse themselves equally through each other accounts for the fact that carbonic acid cannot separate itself from the mass of the atmosphere, and accumulates in low situations by force of gravity.

The principal sources of the formation of carbonic acid are, animal respiration, combustion, and the decomposition of animal and vegetable matter. Growing plants purify the atmosphere by withdrawing carbonic acid, and yielding an equal volume of pure oxygen. At the Grotto del Cane in Italy, and at Pyrmont in Westphalia, the carbonic acid issues directly from the earth.

The best test for the carbonic acid of the atmosphere is lime water, which is rendered turbid, through the conversion of the lime into a carbonate.

SULPHUR.—Sulphur occurs as a mineral production in some parts of the earth, especially in the neighbourhood of volcanoes, as in Italy and Sicily. It is now procured in large quantities from the Dublin mountains, where it is found in combination with potassium. It is a solid, inflammable substance, of a light-yellow colour, very brittle, with little or no taste, *and emits* a peculiar odour when rubbed. It is highly *inflammable,* and in burning combines with oxygen, *forming* a pungent and suffocating gas, which is sul*phurous acid.* It is a non-conductor of electricity,

and is excited negatively by friction. It melts at a temperature of 216° or 220°, and becomes very thin and fluid at 250°. When melted, and poured into cylindrical moulds, it forms the "*roll sulphur*," which, when held in a warm hand, gives a crackling noise, and often falls to pieces, having little cohesion, and being unequally expanded by heat, as it is a bad conductor of caloric. Sulphur combines with chlorine, iodine, carbon, phosphorus, and almost all the metals. Its chemical equivalent is 16. Fused sulphur has a tendency to crystallize on cooling; and the primary form of its crystals is an acute octahedron, with a *rhombic base*, subject to various modifications. It is insoluble in water and alcohol, but soluble in oil of turpentine and fatty oils, but its best solvent is the bisulphate of carbon. The compounds of sulphur and oxygen are—

	Sulphur.	Oxygen.	Equiv.
Sulphurous acid	16 or 1 eq.	16 or 2 eq.	32
Sulphuric acid.....	16 or 1 eq.	24 or 3 eq.	40
Hyposulphurous acid	32 or 2 eq.	16 or 2 eq.	48
Hyposulphuric acid	32 or 2 eq.	40 or 5 eq.	72
Sulphuretted hyposulphuric acid ...	48	40	
Bi. ditto	64	40	
Tri. ditto	80	40	

The compounds of sulphur and hydrogen are—

	Hydrogen.	Sulphur.	Equiv.
Hydrosulphuric acid	1 or 1 eq.	16 or 1 eq.	17
Persulphuret of hydrogen	1 or 1 eq.	32 or 2 eq.	33

HYDROSULPHURIC ACID (H S).—This acid, commonly known under the name of sulphuretted hydrogen, is best prepared by heating sesquisulphuret of antimony in a retort, with four or five times its weight of strong hydrochloric acid. An interchange of elements takes place, sesquichloride of antimony and hydrosulphuric acid are generated, the latter of which escapes with *effervescence*.

Properties.—*Colourless gas*, which reddens litmus

paper feebly, and is distinguished from all other gases by its offensive taste and odour, which are similar to those of putrid eggs, or sulphurous springs. It is extremely deleterious to animal life; an atmosphere containing 1-250th of its volume of this gas destroys a horse; it extinguishes all burning bodies; but the gas takes fire when a lighted paper is immersed in it, and burns with a pale blue flame. Water and sulphurous acid are the products of its combustion, and sulphur is deposited.

The salts of hydrosulphuric acid are called *hydrosulphates*, or *hydrosulphurets*. The most delicate test for the presence of this gas, when diffused in the air, is moist carbonate of lead spread on white paper, which very speedily turns black.

PHOSPHORUS.—When bones are burned to whiteness in an open fire, all the animal matter which they contain is destroyed, and nothing remains but a solid mass, of a white colour, consisting almost entirely of phosphate of lime, a compound of phosphoric acid and lime. By reducing the phosphate to a fine powder, and digesting it for a day or two with three-fourths of its weight of sulphuric acid, its decomposition is effected, and two new salts are formed—a sparingly soluble sulphate, and a soluble superphosphate of lime. The latter is dissolved in warm water, and the solution, after being filtered to separate it from the sulphate of lime, is evaporated to the consistence of a syrup, mixed with a fourth of its weight of powdered charcoal, and strongly heated in an iron retort luted with clay. In this process the oxygen of the phosphoric acid, which is in excess in the superphosphate, combines with the carbon, forming carbonic oxide and carbonic acid gases, which are evolved. The phosphorus distils over, and is condensed in water, and *phosphate of* lime, together with the excess of *charcoal, remains in* the retort.

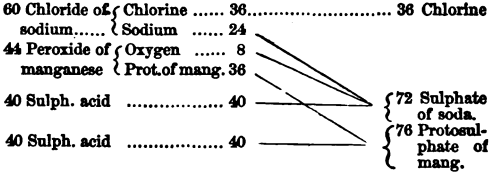
Properties.—When pure, transparent and nearly

colourless; soft; of a waxy appearance and consistence when cut; at 108° it fuses; and at 550° it is vaporized. It is highly inflammable; when exposed to the air, under common temperatures, it undergoes slow combustion, emits a white vapour, appears distinctly luminous in the dark, and is gradually consumed. On this account phosphorus should always be kept under water. It is soluble, by the aid of heat, in naphtha, in fixed and volatile oils, in the chloride of sulphur, sulphuret of carbon, and sulphuret of phosphorus. Its equivalent is 16. Its compounds with oxygen are—

	Phosphorus.	Oxygen.	Equiv.
Oxide of phosphorus.....	48 or 3 eq.	8 or 1 eq.	56
Hypophosphorous acid...	32 or 2 eq.	8 or 1 eq.	40
Phosphorous acid.....	32 or 1 eq.	24 or 3 eq.	56
Phosphoric acid ... Pyrophosphoric acid ... Metaphosphoric acid	32 or 2 eq.	40 or 5 eq.	72

CHLORINE.—This gas may be obtained by heating hydrochloric acid with peroxide of manganese in a glass retort. The hydrogen of the hydrochloric acid combines with a portion of the oxygen of the peroxide of manganese, forming water, and its chlorine is evolved. Another portion of the hydrochloric acid is re-acted on by the protoxide of manganese, the results being chloride of manganese and another atom of water.

Chlorine may also be obtained by mixing common salt, peroxide of manganese, and diluted sulphuric acid. One equivalent of the sulphuric acid expels a portion of the oxygen of the peroxide of manganese, and, uniting with the protoxide, forms a protosulphate of manganese. The disengaged oxygen of the manganese unites with the sodium, forming soda, which, combining with the sulphuric acid, forms sulphate of soda, and the *chlorine of the* decomposed chloride of *sodium is evolved.*



Properties.—Chlorine is a yellowish-green coloured gas, which has an astringent taste, and a disagreeable colour. When inspired, it produces spasm of the glottis; and even when very much diluted with air, it causes excessive irritation. According to Davy, 100 cubic inches of dry chlorine weigh between 76 and 77 grains. Cold recently-boiled water absorbs twice its volume of chlorine, and yields it again on being heated. It is a supporter of combustion, under some circumstances, and unites with some substances, especially metals, with the evolution of heat and light.

One of the most remarkable properties of chlorine is its bleaching power. Davy proved that chlorine cannot decolorize substances unless moisture be present. It is supposed that the chlorine decomposes any water which may be present in the substance to be bleached, and combining with its hydrogen, forms hydrochloric acid; and that the colouring matter is removed by the agency of the free oxygen. Chlorine also acts probably on the same principle as a powerful disinfecting agent. The equivalent of chlorine is 36. The compounds of chlorine and oxygen are—

	Chlorine.	Oxygen. Equiv.
Hypochlorous acid.....	36 or 1 eq.	8 or 1 eq.=44
Chlorous acid.....	36 or 1 eq.	16 or 2 eq.=52
Chloric acid.....	36 or 1 eq.	40 or 5 eq.=76
*Per*chloric acid	36 or 1 eq.	56 or 7 eq.=92

The euchlorine of Davy is probably a mixture of *chlorous acid* and free chlorine.

IODINE.—Iodine is a simple elementary non-metallic body, existing, in combination with sodium or potassium, in sea-water, and most marine plants and animals. It exists also in this state in many salt and other mineral springs, both in this country and on the Continent. It may be obtained from the dark residual liquor that remains after the carbonate of soda has been obtained from kelp, by treating it with sulphuric acid. When the acid is added, the iodide decomposes some water; the iodine, combining with its hydrogen, forms hydriodic acid, and the base unites with the oxygen, forming potass, or soda, with which the sulphuric acid unites, forming a sulphate. The hydriodic acid is next decomposed by peroxide of manganese and heat; the excess of oxygen of the peroxide unites with the hydrogen of the hydriodic acid, forming water, and when the solution is heated, the iodine sublimes, and may be collected in cool glass receivers.

Properties.—Iodine, at common temperatures, is a solid, of a greyish-black colour and metallic lustre. It is often in scales, similar to those of micaceous iron ore, sometimes in rhomboidal plates, very large and brilliant. Its taste is very acrid, though it is very sparingly soluble in water. It gives a deep-brown stain to the skin, which soon vanishes by evaporation. It dissolves in 7000 parts of water. It is a non-conductor of electricity, and is a negative electric. It possesses bleaching properties.

The best test for iodine is starch; and so delicate is this reagent, that a liquid containing 1-450,000th of its weight of iodine receives a blue tinge from a solution of starch. The iodine must be free for this purpose. When in combination, the addition of a little chlorine would set free the iodine, and determine the experiment. Its equivalent is 126.

HYDRIODIC *ACID.*—*Iodine* combines with hydrogen *in one proportion only, the* compound thus formed

being composed of one atom of each of its co stituents.

Preparation.—Hydriodic acid may be formed l the direct union of its elements, when a mixture hydrogen gas and iodine vapour are transmitt through a porcelain tube at a red heat. It may al be prepared by the action of water on the periodi of phosphorus. Mutual decomposition takes plac the oxygen of the water unites with the phosphoru forming phosphoric acid, and its hydrogen combin with the iodine, forming hydriodic acid, which pass off in the form of a colourless gas.

Properties.—Hydriodic acid gas has a very so taste, reddens vegetable blues, produces dense whi fumes when mixed with the atmosphere, and has odour similar to that of hydrochloric acid gas. It decomposed by oxygen, chlorine, mercury, and seve other substances, having affinity for either of i elements.

The compounds of iodine and oxygen are—

	Iodine.	Oxygen. Equiv.
Oxide of iodine ... } Iodous acid ..... }	Composition unknown.	
Iodic acid.....	126 or 1 eq.	40 or 5 eq.=166
Periodic acid	126 or 1 eq.	56 or 7 eq.=182

IODIC ACID.—When iodine is brought into cont with protoxide of chlorine, immediate reaction ensue the chlorine unites with one portion of iodine, and t oxygen with another, forming two compounds, volatile, orange-coloured matter, chloride of iodi and a white solid substance, which is *iodic acid.* applying heat, the former passes off in vapour, and t latter remains.

Properties.—It is a white, semi-transparent sol which has a strong, astringent, sour taste, but *odour.* It is very soluble in water, has strong a *properties, and* unites with numerous bases. Its *gr. is considerable,* as it sinks rapidly in sulphu

acid. It forms the best test for *morphia*, which decomposes it, and sets iodine free, whilst the other vegetable alkalis do not.

Bromine.—This substance, which closely resembles iodine in its general properties, exists in sea-water and marine plants, in the form of bromide of magnesium. It is procured by passing chlorine gas through bittern; the chlorine combines with the magnesium, forms a chloride of magnesium, and bromine is set free.

Properties.—At ordinary temperatures bromine exists in the state of a blackish-red liquid, of an extremely offensive odour. Its sp. gr. is 3; it is a negative electric, and is highly deleterious to animal life. It is soluble in water, alcohol, and ether, the latter being its best solvent. Like chlorine and iodine, it possesses bleaching properties. It forms compounds with oxygen, hydrogen, the simple combustibles, metals, &c. Its equivalent is 78·4.

Fluorine.—This element has never been obtained in a free state, in consequence of its extraordinary chemical affinity towards the metals, and towards silicium; its properties are therefore unknown. It exists in the hard bones, and especially in the enamel of the teeth, as the fluorate of lime.

Silicium or *silicon* is found united with oxygen forming silica, the earth of flints. It is not used in medicine.

Boron is closely related to silicium; it is the basis of boracic acid.

COMPOUNDS OF CARBON AND HYDROGEN.

For many years chemists have been acquainted with two compounds of carbon and hydrogen—viz., carburetted hydrogen and olefiant gases; but of late years *several compounds of* a similar nature have been *added to the above.* Many of these compounds have

a tendency to unite with acids, and even to neutralize them, although in their uncombined state they do not possess alkaline characters. Some of them, although compounds, exhibit, in their combinations with other substances, the characteristics of elements. Hence they have been called *compound radicals*. The following tabular view, taken from the "Elements of Chemistry of the late Dr. Turner, revised by Liebig and Mr. W. G. Turner," represents the composition of the compounds which have as yet been studied:—

	Hydrogen.	Carbon.	Equiv.
Light carburetted hydrogen	2	2 eq.+ 6·12	1 eq.= 8·12
Olefiant gas	2	2 eq.+12·24	2 eq.=14·24
Etherine	4	4 eq.+24·48	4 eq.=28·48
Paraffine, Eupione, Rose oil stearine, Wax oil		Same ratio of elements as in etherine, but eq. is unknown.	
Benzin, or bicarburet of hydrogen	3	3 eq.+36·72	6 eq.=39·72
Naphtha	5	5 eq.+36·72	6 eq.=41·72
Oil of turpentine, Citrine, Camphire, Oil of copaiva, Juniper oil, Lemon oil, Savin-tree oil, Black pepper oil	8	8 eq.+ 61·2	10 eq.= 69·2
Naphthaline, Paranaphthaline	4	4 eq.+ 61·2	10 eq.= 65·2
Idrialine	7	7 eq.+122·4	20 eq.=129·4

The *light carburetted* hydrogen is plentifully generated in stagnant waters, and in coal mines, where it is known by the name of *fire damp*, and often gives rise to terrible explosions. It was to guard against danger from this gas, that Sir H. Davy invented his *safety lamp*; which consists of an oil lamp, covered with a net-work of metal so fine that flame will not pass through it.

Olefiant gas is so called, because, when mixed with *chlorine, it* forms a dense oily liquid, which has been *called chloric* ether, or chloride of hydro-carbon. It

is formed by distilling alcohol with strong sulphuric acid. *Vide Ether, preparation of.*

By the above table, it will be seen how very closely many substances, which have remarkable differences in the sensible properties, agree in their internal composition.

CYANOGEN.—Cyanogen is obtained by decomposing the dry and crystallized cyanuret of mercury by heat, and collecting the gas over mercury as it is given off.

Properties.—Cyanogen is a permanently elastic fluid. Its smell is very strong and penetrating. Its solution in water has a sharp taste. It burns with a bluish flame mixed with purple. Its sp. gr. is 1·8064. It is composed of nitrogen $1 = 14$, carbon $2 \times 6 = 12 = 26$

By volume, it is composed of two volumes of the vapour of carbon and one volume of nitrogen condensed into one volume.

Cyanogen combined with hydrogen forms the *hydrocyanic* acid, of poisonous notoriety, and with oxygen forms a peculiar acid, the *cyanic*, composed of—1 cyanogen, $26 + 1$ oxygen $8 = 34$.

This acid is remarkable, inasmuch as one of its compounds, *i.e.*, cyanate of ammonia, has precisely the same elements as *urea*, the well-known excrementitious substance found in the urine.

Paracyanogen.—This is a brown or blackish substance, formed when cyanogen is prepared by heating the cyanide of mercury. It is insoluble in water and alcohol, and contains carbon and nitrogen in the same proportions as in cyanogen.

METALS.

Metals are distinguished from other bodies by the following properties. They are all conductors of heat and electricity. They are heavy, opaque, have a metallic lustre, *and some of them* are very malleable *and ductile. They combine* with oxygen, chlorine,

iodine, sulphur, phosphorus, and similar substances; and when these compounds are decomposed, the metals appear at the negative pole of the battery, and are hence said to be positive electrics. By particular arrangements several of them can be obtained in a crystallized state, and their crystals are generally cubes, or octahedrons.

Gold, platinum, silver, palladium, cadmium, lead, copper, iron, tin, zinc, nickel—also potassium, sodium, and mercury, when frozen—are ranked as malleable metals. The last metals are not so malleable as the first, and gold exceeds all others in this respect; a single grain can be beaten into a leaf which will cover 54¼ square inches, and which is not above 1-282,000th of an inch in thickness.

Metals combine with each other, forming compounds, called *alloys;* the compounds of mercury with other metals are called *amalgams.*

The metallic bases of the alkalies are three in number—Potassium, sodium, lithium.

The metallic bases of the alkaline earths are four in number—Barium, calcium, magnesium, strontium.

The metallic bases of the earths are five in number—Aluminium, thorinum, glucinium, zirconium, yttrium.

According to some chemists, the base of silica is supposed to be a metal, to which the term *silicium* is applied. The experiments of Berzelius appear almost completely to disprove such an hypothesis. Hence, under the name of *silicon,* the non-metallic base of silica is classified with carbon and boron. Those who suppose it to be a metal place it under the same class as aluminium, &c.

The metals which decompose water at a red heat, are seven in number—Manganese, iron, zinc, tin, cadmium, cobalt, nickel.

The metals that do not decompose water at any *temperature,* and the oxides of which are not reduced *to the metallic* state by the sole agency of heat, are

fourteen in number—Arsenicum, chromium, vanadium, molybdenum, tungsten, columbium, antimony, uranium, cerium, bismuth, titanium, tellurium, copper, lead.

The metals, the oxides of which are reduced by a red heat, are eight in number—Mercury, silver, gold, platinum, palladium, rhodium, osmium, iridium.

These are called *noble* metals, both from their value, and from their incorrodibility by the atmosphere.

The alkalifiable metal, *potassium*, was discovered by Sir H. Davy in the year 1807. He obtained it by exposing the hydrate of potassa (moistened a little, in order to increase its conducting power) to the action of a galvanic battery of 200 double plates; the oxygen, both of the potassa and the water, was evolved at the positive pole, while the hydrogen of the water and the potassium of the potash appeared at the negative wire. Gay-Lussac and Thenard prepared this metal in larger quantities afterwards, by fusing the hydrate of potassa, and causing it to flow over iron turnings heated to whiteness in a gun-barrel. The oxygen, both of the water and the potassa, is attracted by the iron, a little potassuretted hydrogen escapes, and the potassium is condensed in a receiver connected with the gun-barrel. Naphtha is the liquid which must be contained in the receiver in which the potassium is condensed, as this metal decomposes every fluid which contains even the minutest proportion of oxygen. A third process was first pointed out by M. Caraudua, which consisted in mixing dry carbonate of potassa with half its weight of powdered charcoal, and exposing this mixture, contained in a spheroidal iron bottle or a gun-barrel, to a strong heat. This process was afterwards improved by M. Brunner, who decomposed potassa by iron and charcoal; and Wohler has since introduced another modification of these processes—decomposing potash by means of charcoal *only*.

Properties.—It is solid at ordinary temperatures. It

is fluid at 150° Fahr. It is very similar to mercury in colour and lustre. It is opaque, and is a good conductor of caloric and electricity. When potassium is thrown into water, it immediately decomposes it; one proportion rapidly attracts its oxygen, forming potash; another portion combines with its hydrogen, forming potassuretted hydrogen, a highly inflammable compound, which takes fire at the moment of its evolution, and is resolved into potash and water. The potassium swims on the surface of the water until it is completely oxidated, at the same time burning with a rose-coloured flame. Forty grains of potassium decompose nine grains of water, the hydrogen being evolved in the gaseous form, and the eight grains of oxygen uniting with the potassium to form the alkali, potassa.

Sodium may be prepared in the same manner as potassium. It also may be procured by mixing chloride of sodium with potassium, and distilling from an iron retort; the potassium unites with the chlorine, forming a chloride of potassium, which remains, and the sodium is volatilized.

Properties.—Sodium resembles potassium very much in all its chemical properties; when thrown on cold water, however, it does not take fire, like potassium. When put into hot water, it scintillates, or even occasionally takes fire.

Lithium, a white-coloured metal, like sodium, was obtained by Davy, by the action of galvanism on lithia.

Calcium may be obtained by exposing lime to the action of a strong galvanic battery in contact with mercury. By this method is obtained an amalgam of mercury and calcium, on exposing which to heat, the mercury is volatilized and the calcium remains. When calcium is heated gently in the air, it burns with an *intense white* light, and forms lime. When it is thrown *into water*, hydrogen is driven off, and a solution of *lime is formed*.

Arsenicum sometimes occurs native, but more frequently it is found alloyed with cobalt, iron, and other metals. On roasting these ores in a reverberatory furnace, the arsenicum, from its volatility, is driven off, and, combining with oxygen as it rises, condenses into thick cakes on the roof of the chimney. The oxygen which it thus acquires is removed by heating it with carbon, and pure arsenicum is obtained.

Properties.—The metal arsenicum has an iron-grey colour; it possesses considerable lustre, and has a crystalline fracture. When exposed to the air, it tarnishes rapidly, a black powder being formed, which Berzelius regards as a protoxide. When exposed to a heat of 356° Fahr. it sublimes.

Metallic mercury is found in small quantities in nature; but it is generally obtained from the ore called *cinnabar*, which is a bisulphuret of mercury. It is obtained from this by mixing equal portions of the sulphuret and iron filings, throwing an additional quantity of the iron filings over the mixture, and exposing it to a dull-red heat in an iron bottle, with an iron tube or bent gun-barrel attached to it, the open end of which should be put into water. The sulphur combines with the iron, forming a sulphuret of iron, and the mercury is volatilized, and condenses in drops in the iron tube. Lime is sometimes used instead of iron; in that case, a sulphuret of calcium will remain in the iron bottle.

Properties.—Pure mercury has a bright white metallic lustre, rather bluer, however, than that of silver. It is the only metal which assumes the fluid form at the ordinary temperature of the atmosphere. It becomes solid at a temperature of 39 or 40 degrees below zero; and in congealing has a great tendency to crystallize in octahedra. When solid, it is malleable, and may be cut with a knife. At about 662° Fahr. it boils. The equivalent *of mercury is 202.* Metallic mercury can *assume the form of a vapour* at ordinary temperatures.

A TABLE OF PHARMACEUTICAL METALS AND THEIR OXIDES.

	Base.	Oxygen.	Equiv.	Colour.
ALUMINIUM			13·7	grey.
Sesquioxide	26·4 or 2 eq.	+ 24 or 3 eq.	= 51·4	white.
ANTIMONY			= 64·6	white, with a bl. grey tinge.
Sesquioxide	129·2 or 2 eq.	+ 24 or 3 eq.	= 153·2	white.
Antimonious acid	129·2 or 2 eq.	+ 32 or 4 eq.	= 161·2	white.
Antimonic acid	129·2 or 2 eq.	+ 40 or 5 eq.	= 169·2	white.
SILVER			= 108	white.
Oxide	108	or 1 eq. + 8 or 1 eq.	= 116	brown.
ARSENICUM			= 37·7	iron grey.
Oxide	composition not known			black.
Arsenious acid	75·4 or 2 eq.	+ 24 or 3 eq.	= 99·4	white.
Arsenic acid	75·4 or 2 eq.	+ 40 or 5 eq.	= 115·4	white.
BARIUM			= 68·7	dark grey.
Protoxide	68·7 or 1 eq.	+ 8 or 1 eq.	= 76·7	grey.
Peroxide	68·7 or 1 eq.	+ 16 or 2 eq.	= 84·7	
BISMUTH			= 71	reddish white.
Protoxide	71	or 1 eq. + 8 or 1 eq.	= 79	yellow.
Peroxide, or Teroxide	142	or 2 eq. + 24 or 3 eq.	= 166	brown.
Bismuthic acid	71	or 1 eq. + 40 or 5 eq.	= 111	
CALCIUM			20·5	whitish grey.
Protoxide	20·5 or 1 eq.	+ 8 or 1 eq.	= 28·5	white.
Binoxide	20·5 or 1 eq.	+ 16 or 2 eq.	= 36·5	white.
COPPER			31·6	red.*
Dinoxide	63·2 or 2 eq.	+ 8 or 1 eq.	= 71·2	red.
Protoxide	31·6 or 1 eq.	+ 8 or 1 eq.	= 39·6	black.
Superoxide	31·6 or 1 eq.	+ 16 or 2 eq.	= 47·6	deep yell.
IRON			28	grey.
Protoxide	28	1 eq. + 8 or 1 eq.	= 36	green.
Peroxide†	56	2 eq. + 25 or 3 eq.	= 80	red.

* *Titanium* is the only other metal that has a red colour.
† *Called sesquioxide* in the Pharmacopœia.

	Base.	Oxygen.	Equiv.	Colour.
Black Oxide { Protoxide.	36	or 1 eq.	=116	black.
Black Oxide { Peroxide .	80	or 1 eq.		
Mercury			202	bright white.
Suboxide	404	or 2 eq.+ 8 or 1 eq.	=412	grey.
Protoxide	202	or 1 eq.+ 8 or 1 eq.	=210	black.
Peroxide	202	or 2 eq.+16 or 2 eq.	=218	red.
Magnesium			12·7	white.
Protoxide	12·7	or 1 eq.+ 8 or 1 eq.	= 20·7	white.
Lead			103·6	bluish grey.
Dinoxide	207·2	or 2 eq.+ 8 or 1 eq.	=215·2	dark grey.
Protoxide	103·6	or 1 eq.+ 8 or 1 eq.	=111·6	lemon yell.
Peroxide	103·6	or 1 eq.+16 or 2 eq.	=119·6	puce.
Red Oxide { Protoxide. Peroxide .	223·2 or 2 eq. 119·6 or 1 eq.		=342·8	red.
Potassium			=39·15	bright white.
Protoxide	39·15	or 1 eq.+ 8 or 1 eq.	=47·15	white.
Peroxide	39·15	or 1 eq.+24 or 3 eq.	=63·15	orange.
Sodium			23·3	white.
Protoxide	23·3	or 1 eq.+ 8 or 1 eq.	=31·3	greyish.
Peroxide	46·6	or 2 eq.+24 or 3 eq.	=70·6	orange.
Zinc			32·3	bluish white.
*Protoxide**	32·3	or 1 eq.+ 8 or 1 eq.	=40·3	white.
Peroxide	composition not ascertained		...	white.

ON THE NATURE OF ACIDS, BASES, AND SALTS.

The general tendency of simple bodies is to enter into combinations which are *binary*, that is to say, composed of two elements; for instance, *chloride of sodium*, which consists of chlorine and sodium.

When binary compounds are subjected to a current of voltaic electricity, they are decomposed, one element going to the positive pole, the other to the negative.

By that rule of contrary, which is the essence of

* *Berzelius describes a sub-oxide* which is of a grey colour.

electrical attraction, the element which goes to the *positive* pole is called an *electro-negative*, whilst that which goes to the *negative* pole is called an *electro-positive*.

Electro-negative substances are generally supporters of combustion—viz., oxygen, chlorine, acids, &c.

Electro-positive substances are generally combustible —viz., carbon, metals, &c.

But these terms are only *relative;* for a body such as sulphur may be electro-positive with oxygen—when it forms sulphuric acid, for example;—and electro-negative with metals, in forming sulphurets.

In binary compounds, then, one element is electro-negative, and this is generally the more energetic of the two; the other, electro-positive, and this, which is the more inert of the two, is called the BASE. Thus in oxide of iron, the oxygen is the electro-negative, or active element; the metal is the base.

But three or more elements may enter into the composition of a body; in these cases, however, it is not supposed that three or four are combined directly; but that two having first united, then unite with the third.

A body formed out of two others may have all the properties of a simple body, that is, may act either as electro-negative, or as base.

Thus cyanogen is a compound substance formed of nitrogen and carbon; yet it acts towards metals just as chlorine and oxygen do, forming binary combinations, called *cyanides*.

Thus also ammonium is a compound body formed of nitrogen and hydrogen,* which acts towards chlorine and oxygen just as the metals do; the chloride of ammonium (hydrochlorate of ammonia) being quite analogous to any other chloride.

* *Its* composition is 1 eq. nitrogen 14, and 4 of hydrogen 4, and *its Eq. No. 18.* Although never yet isolated, it has all the properties of a metal, forming an amalgam with mercury. When 1 *eq. of oxygen* is added, it is converted into ammonia and water.

Now a SALT is a binary compound of an electro-negative and a base.

Both elements may be simple, as in the chloride of sodium, Cl + Na; or one of them may be compounded, as in the cyanide of iron, C_2N (cyanogen) + Fe, where the electro negative is compound, or the chloride of ammonium, Cl + N H, where the base is compound; or both may be compound.

Salts are often formed, not *directly*, by the union of their two constituents—as, for instance, by putting chlorine and sodium together—but *indirectly*, by putting together two other compounds of the constituents, which then decompose each other. Thus chloride of sodium is readily formed by adding hydrochloric acid (hydrogen and chlorine) to soda, (sodium and oxygen.) These decompose each other:

$$\left.\begin{array}{l}\text{Hydrochloric}\\ \text{acid}\end{array}\right\}\begin{array}{l}\text{Hydrogen.....Oxygen}\\ \text{Chlorine .....Sodium}\end{array}\Big\}\ \text{Soda}$$

the chlorine betaking itself to the sodium, and the oxygen with the hydrogen forming *water*.

It may be noticed, by the way, that there are few instances of *indirect* formation of salts, in which water is not made or decomposed out of the oxygen and hydrogen.

The usual modes of forming a salt *indirectly* are by employing *acids* which contain the electro-negative constituent, and *oxides*, which contain the base; as in the example of hydrochloric acid and soda just mentioned.

Acids have generally a sour taste, and redden blue litmus paper. Oxides (or alkalies) have a hot urinous taste, and turn vegetable blues green, and redden turmeric paper.

(It used to be said that the essential part of acids was the oxygen they *contain*, and that oxygen was the grand *acidifying principle*, &c. But this is opposed to *modern theory*, because many acids have no oxygen

at all; the hydrochloric, for example; and in those which have, it can be shown that it is not the real acidifying principle.) On the contrary,

Acids are compounds of hydrogen with some electro-negative body, simple or compound; hydrochloric acid is composed of hydrogen and chlorine, both simple; hydrocyanic acid, of hydrogen and cyanogen, the latter compound.

The way in which acids unite with metallic oxides to form salts, is this: the hydrogen of the acid forms water with the oxygen of the oxide, and the electro-negative combines with the metal.

A very large class of acids contain oxygen; the sulphuric, nitric, &c., and their composition is usually stated to be one eq. sulphur, and three oxygen for the sulphuret, one eq. nitrogen and five oxygen for the nitric, &c. But these acids *without water* are not acids; the nitric, oxalic, and many others, cannot exist, but are decomposed, if deprived of one eq. of water, and those which can exist in an *anhydrous* state (as the sulphuric), do not exhibit the properties of acids until water is supplied.

This being the case, it is certain that instead of nitric acid (or any other oxygen acid) containing 1 nitrogen, 5 oxygen, and 1 water, that it really is a binary compound of 1 nitrogen and 6 oxygen, on the one hand, and 1 hydrogen on the other.

The symbol of sulphuric acid also would be, not $S O_3 + H O$, but $S O_4 + H$.

Thus we see clearly the similarity of the oxygen acids, so called, to the hydrogen acids; and also why every oxide requires as many eq. of acid to saturate it as it has itself eq. of oxygen.

Thus a protoxide is saturated with one eq. of acid, a sesqui-oxide with $1\frac{1}{2}$, and a binoxide with two, each *eq. of oxygen* in the oxide requiring one of hydrogen in *the acid to* form water.

Thus 1 eq. protoxide of mercury..... $Hg+O$.
and 1 eq. of hydrochloric acid ..... $Cl+H$.
form
1 eq. protochloride of mercury ... $Hg+Cl$.
and 1 eq. water ..... $H+O$.
and
1 eq. binoxide of mercury ..... $Hg+O_2$
with 2 eq. sulphuric acid.....$S_2O_6+H_2$
form
1 eq. bisulphate of mercury .....S_2O_6+Hg
with 2 eq. water ..... H_2+O_2

We see also by these formulæ, that *in every salt the metal takes the place of the hydrogen of the acid.**

ORGANIC CHEMISTRY.

Organized beings differ from inorganic substances thus—

ORGANIZED.	UNORGANIZED.
Have, or have had life.	Lifeless.
Definite shape, size, and form.	May be of almost any shape, size, and form.
Rounded in form.	If of particular shape, are angular or crystalline.
Composed of parts or organs which have functions.	No organs, and no functions.
Increase in size from nourishment taken into their composition.	Only increase in size by addition from without.

The elementary substances which are met with in plants are—

1. Carbon .....
2. Oxygen.....
3. Hydrogen .
4. Nitrogen ...

} their most essential components.

* The *substance of this section is* taken from Professor Liebig's *Lectures.*

5. Sulphur ...	found principally in vegetable albumen and gums, and especially in the tetradynamia, combined with nitrogen.
6. Phosphorus.	
7. Potassium .	..... almost universally.
8. Sodium	..... principally in marine plants.
9. Calcium ...	..... almost universally.
10. Aluminium.	..... rarely.
11. Silicon.	
12. Magnesium.	occurring rarely.
13. Iron	..... frequently.
14. Manganese.	
15. Chlorine.	
16. Iodine	..... in marine plants.
17. Bromine ...	

The same substances, with the exception of aluminium, are met likewise in the animal kingdom. Here sodium is more frequent, potassium less frequent, than in plants; iodine and bromine occur in some marine animals.

In man and the higher animals the components are—

1. Oxygen.	
2. Hydrogen.	
3. Carbon.	
4. Nitrogen.	
5. Sulphur ...	met with principally in the hair, albumen, and brain.
6. Phosphorus.	..... in the bones, teeth, and brain.
7. Chlorine ...	met with in the teeth and bones.
8. Fluorine ...	
9. Potassium ...	
10. Sodium	
11. Calcium.....	
12. Magnesium.	

13. Manganese. } found in the hair.
14. Silicon ... .. }
15. Iron ..... } ..... in the blood, bile, pigmentum nigrum, and crystalline lens.

VEGETABLE CHEMISTRY.

Vegetable substances are in general easily decomposed. None of them can bear even a dull-red heat, and most of them suffer decomposition at a much lower temperature.

Vegetable substances may be divided into five classes: 1st, acids; 2nd, alkalies; 3rd, substances in which hydrogen predominates; 4th, substances in which hydrogen and oxygen are in the proportion to form water; 5th, nitrogenous aliments.

CLASS I.—*Of the vegetable acids.*—Vegetable acids, like other acids, redden the vegetable blues, and combine with the salifiable bases, forming neutral salts. Most of them can be obtained in a solid state, and are soluble in water, and a great part of them are also soluble in alcohol. When heated in vessels, so as to exclude the action of the air, the principal products are, carbonic acid, carbonic oxide, water, acetic acid, and an empyreumatic oil. By nitric acid they are generally converted into oxalic acid; and when heated with sulphuric acid, they abstract a portion of its oxygen, and sulphurous acid gas is evolved.

The more common acids which exist ready formed in vegetables are, the acetic, tartaric, citric, oxalic, benzoic, malic, gallic, hamic, and hydrocyanic acids; besides which are the pyrotartaric, racemic, aconitic, or equisetic, citraconic, itaconic, fumaric, meconic, comenic, pyrocomenic, and kinic, of less importance to medical science.

1. *Acetic acid.*—This acid is described in the next Part.

2. *Tartaric acid.*—*This* acid exists in vegetables

generally in combination with potash, forming a bitartrate. It may be procured from the pulp of the *tamarindus indica*, the juice of the *vitis vinifera*, and of the *morus nigra*. *Vide* next Part.

3. *Citric acid.*—This acid exists in the juice of the *citrus aurantium*, and *c. medica*, of the cranberry and whortleberry (*vaccinium oxycoccos*) and *v. vitis-idea*, of the *rosa canina*, and several other fruits.

4. *Oxalic acid.*—*Vide* p. 146.

5. *Benzoic acid.*—Benzoic acid occurs in several of the balsams, or resins, as benzoin, storax, balsam of tolu, &c. It has also been found in the *epidendrum vanilla*, the *laurus cinnamomum*, the *dipterix odorata*, the *melilotus officinalis*, the *acorus calamus*, the *holcus odoratus*, and the *pimpinella anisum*; also in the urine of herbivorous animals, and of infants: and in all these it is *combined with resinous matter*.

6. *Malic acid.*—This acid exists in an uncombined state in various fruits, (as *apples, pears, prunes*, &c.,) and in the leaves of the *sempervivum tectorum*. It is mixed with citric acid in the gooseberry and raspberry, with citric and tartaric acids in the pulp of *tamarind*, and with oxalic acid in the *cicer arietinum*. *Sorbic acid* is merely malic acid in a state of great purity.

This acid may be extracted from the juice of the house-leek (*sempervivum tectorum*,) by precipitating with acetate of lead, and decomposing the precipitate with diluted sulphuric acid.

7. *Tannic and gallic acids.*—These acids exist in gall-nuts, and most astringent vegetables. Tannic acid may be procured by digesting gall-nuts in ether; gallic acid seems to be tannic acid in a higher state of oxidation. Both yield dark-blue precipitates with persalts of iron, well known under the name of ink. Tannic acid precipitates gelatine, and renders it insoluble in water; hence its use in *tanning* skins, which consist almost entirely of gelatine. It is a capital antidote for tartar emetic.

8. *Hydrocyanic acid.*—*Vide* Toxicology.

Pyrotartaric acid is produced in the destructive distillation of tartaric acid, and forms a semi-fluid black mass, containing an empyreumatic oil and a residue of charcoal.

Racemic acid is produced with and resembles tartaric acid, except that it does not rotate the plane of polarization.

Aconitic or Equisetic acid is obtained when crystallized citric acid is heated in a retort until it becomes coloured.

Fumaric acid is obtained from malic acid.

Meconic acid.—See Opium.

Comenic acid is a product of the decomposition of the meconic.

Pyrocomenic is produced from the preceding.

Kinic acid is found in the solution from which the alkalies of genuine bark have been separated by hydrate of lime.

CLASS II.—*Of the Alkaloids, or Vegetable Alkalies.*—The vegetable alkalies are a class of compounds, containing nitrogen, the discovery of which may be dated from 1816. They are called alkalies because they possess the general properties of these substances, saturating the acids, and forming crystallizable compounds with them. They differ, however, from the mineral alkalies, excepting ammonia, in several respects. 1st, the alkaloids contain nitrogen, the mineral alkalies do not; 2nd, the alkaloids are but very slightly soluble in water, the mineral alkalies are very soluble; 3rd, the alkaloids are decomposed by a moderate heat, the mineral alkalies are not; 4th, the alkaloids do not form soaps with oil, the alkalies do.

The same mode of preparation is employed for them all. A watery solution of the vegetable matter is prepared, which contains *the vege*table alkaloid, held in solution *by a vegetable acid*; a watery solution of *opium, for instance, contains* the alkaloid morphia,

in combination with meconic acid; a mineral alkali is added, which unites with the acid, and precipitates the alkaloid; then the latter is dissolved by pure boiling alcohol, and obtained on cooling, or by distillation. The foreign matters which may adhere to the precipitates are removed by boiling with a weak acid and animal charcoal, after which, the alkaloid is again precipitated by the addition of an alkali.

Processes for obtaining the most important alkaloids will be found in another part of this work.

CLASS III.—*Vegetable Substances, in which Hydrogen predominates.*—These substances are of an oily, resinous, or ethereal nature, and are highly inflammable. They are generally composed of about carbon 80, hydrogen 11, and oxygen 9 per cent.

Those fatty bodies which are liquid at ordinary temperatures are called *oils*, and are common to both the vegetable and the animal kingdom. Those, on the other hand, which are concrete at the ordinary temperature, are called *fats*, and belong principally to the animal kingdom. The *croton sebiferum* is the only vegetable known which produces a real fat.

Many chemists regard the fatty bodies as compounds of *olefiant gas* and *water*: as, for example, *olive oil* corresponds to a mixture of about 90 parts of *olefiant gas* and 10 of water.

Oils are generally divided into *fixed* and *volatile*.

The *fixed oils* are yielded only by the fruit of vegetables, and in the greatest quantity by the dicotyledonous seeds, such as almonds. Chevreul and Braconnet have stated that in every fixed oil, and in every fat, there exists two unctuous matters, one of which is liquid at 24°, and the other is solid at the ordinary temperature. Chevreul named the solid substance *stearine*, and the liquid part *oleine* (or *elaine*), while *Braconnet* retained the names *fat* and *oil*.

These two substances may be obtained either by *expression* or by solution. In the former of these pro-

hich is applicable to the oils, the oil is con-
by exposure to a low temperature, and the
d mass is pressed between folds of blotting-
which absorbs the *elaine*, and leaves the

second, which is principally applicable to the
fatty matter is put into a matrass with seven
times its weight of boiling alcohol. After
me the liquid is poured off, and more alcohol
to the residue; and this is repeated until the
lissolved. The alcohol, as it cools, deposits the
in the form of small needles, and retains the
lissolved. The elaine may be obtained from it,
by evaporating it to one-eighth, when the
ill collect on the surface, having the appear-
olive oil. It must be washed with water to
rom the alcohol, which it still retains.

fixed oils are nearly void of smell and taste;
transparent, unctuous, viscid, with a slight
colour, which may be removed by digestion
arcoal. They are lighter than water, with
hey do not mix, except by the agency of an
diate substance, as mucilage, or an alkali.

olatile, or *essential oils*, as they are also called,
erally prepared, by distillation with water, from
etable substances which contain them rising
ith its vapour, and condensing in the receiver.
atile oils differ from each other in colour, smell,
gravity and fluidity. They possess either a
nd irritating, or an aromatic taste. Their
point is generally about 330°, or even higher.
atile oils are, like the fixed oils, mixtures of
ich differ from each other in fluidity, and most
n are composed of one portion which is fluid,
other which is concrete, at ordinary tempe-

Thus they contain *elaine* and *stearine*, which
us proposes to name—
ine and stearoptene. These two portions may

be separated by the same means as *elaine* and *stearine* —viz., by congelation and by alcohol. Like the fixed oils, when exposed to the air they become thick, and acquire a dark colour, absorbing oxygen, and giving out carbonic acid. A resinous matter is formed, which is dissolved by the portion of oil that still remains unchanged.

Resins are a peculiar class of vegetable substances, which are quite insoluble in water, but dissolve readily in alcohol. They are solid substances, brittle, destitute of smell, either insipid or acrid, heavier than water, translucent, and of a yellowish colour. The greater number of them manifest negative electricity when rubbed. Strong acids, fixed and essential oils, alkalies, ether, and alcohol, dissolve the resins. By the action of nitric acid on resins a substance resembling tannin is produced.

The descending sap of all the *coniferæ* is composed of resin, held in solution by, or mixed with, an essential oil. The smaller the proportion of this essential oil present, the more rapidly this *resinous sap* solidifies on exposure to the air.

The *gum resins* are compounds of gum and resin, which are generally mixed with several other vegetable substances. They are partially soluble in alcohol and water; they are soluble in solutions of the alkalies; but acids decompose them. In the *gum resinous sap* of vegetables, the gum is dissolved, and holds the resin in a state of suspension in the form of innumerable spherical globules, which render it milky and opalescent. A part of the resin may also be held in solution by means of the acetic acid, which is found uncombined in many saps.

Wax has been found, like the oils and fats, to be composed of two substances, which differ from each other only in their fusibility and solubility in alcohol. *These two substances* are called *cerine* and *myricine*.

The cerine may be separated from the myricine in

the same way as the elaine of unctuous bodies is separated from the stearine. Cerine is analogous to elaine, and myricine corresponds to stearine. The general properties of cerine are nearly the same as those of wax. By its saponification, margarate of potash and a substance resembling wax, which Boudet and Boissenot named *ceraine*, are obtained.

Wax varies in colour according to the sources from which it has been obtained. *Bees'-wax* is yellow, that from the *myrica cerifera* is greenish, from the *ceroxylum andicola*, dirty green, or pale yellow, and that from the milk of the cow-tree is yellow. There is a species of bees in the Antilles which produce wax of a black colour, that cannot be bleached even by chlorine.

Chlorophyle, or the green matter of vegetables, is supposed by many chemists to be a variety of wax.

CLASS IV.—*Substances, in which Hydrogen and Oxygen are in the proportions to form water.*—*Gum* is obtained by exudation from a great number of plants. The peach, the plum, and the cherry tree afford it in large quantities, and the gum arabic exudes spontaneously from the acacia vera. It likewise exists in almost all vegetables, particularly the different juices, and in the leaves, flowers, and seeds of young plants.

Gum is the plastic substance of vegetable textures, and is found, in larger or smaller masses, on certain shrubs, whose sap vessels superabound in this product.

Starch gum, or *British gum*, is starch which has been exposed to heat, and is thereby rendered soluble in cold water; it is deprived of the property of being coloured blue by iodine. This substance may be regarded as gum in its purest state. The principal difference between this gum and gum arabic is, that nitric acid does not convert the former into mucic acid.

Fecula, or *starch, is a proximate* vegetable principle, *which is usually obtained from* tuberose roots, in which

it exists in their cellular tissue. To procure it from wheat, the grain must be steeped in cold water till it becomes soft, and gives a milky juice when squeezed; it is then to be put into linen bags, and pressed in water. The milky juice which exudes contains the starch, which is soon deposited in the form of a white powder. It may also be obtained from potatoes, by rasping them in a large quantity of water; when the fibrous parts have been removed, the starch will be found suspended in the water, and will be soon deposited.

Fecula, when obtained in a state of purity, is a white powder, of a crystalline appearance, without smell or taste; insoluble in cold water, alcohol, or ether; apparently soluble in hot water, forming a gelatinous solution which gives a coagulum on the addition of alcohol; convertible into sugar by boiling with diluted acids; and into malic and oxalic acids, without any trace of mucic acid, by boiling nitric acid; and, lastly, its cold solution is capable of forming a blue compound with iodine.

Sugar is a substance which exists in the sap of many vegetables; it is generally produced from the juice of the sugar-cane (*arundo saccharifera*, or *saccharum officinarum*). The juice is expressed from the cane by passing it between rollers, brought to a boiling heat, and mixed with a little lime, which neutralizes any acid that may be present; the liquid is then evaporated, and made to crystallize after the scum has been removed. The crystals are surrounded by a brownish fluid, *molasses*, or *treacle*, which is separated by a mechanical process, and *raw sugar* remains.

Sugar is a crystallizable substance, which is extensively distributed in organized nature. It differs from gum in being soluble in alcohol, and in being susceptible of fermenting when it is dissolved in water, *and mixed with yeast*. Nitric acid changes sugar into *oxalic, but not into* mucic acid.

mic composition of the above principles is
o be as follows:—Starch, C_{12} H_{10} O_{10}; gum,
$_{11}$; sugar from the sugar-cane, C_{12} H_{11} O_{11};
ilk, C_{12} H_{12} O_{12}; sugar of grapes, C_{12} H_{14} O_{14}.
ey all consist of carbon and the elements of
ifferent proportions.

V.—Vegetable Nutriments containing Nitro-

dern chemical research has ascertained that
s of vegetables contain three nitrogenised
s—fibrine, albumen, and caseine, precisely
in their composition and properties with the
bumen, and caseine derived from animals.
, one modification of which is called gluten,
ndantly in grain, and in the grape; it coa-
pontaneously from the expressed juices of
t.
n may be obtained by boiling the juice of
vegetables, when it coagulates.
is found abundantly in leguminous seeds;
le in water, and not coagulated by heat.

ANIMAL CHEMISTRY.

ief proximate principles derived from the
ngdom are—1. Gelatine—in the tendons,
rtilages, the skin, and the cellular tissue.
en—principally in the ova, brain, and nerves,
um of the blood, &c. 3. Fibrin—in mus-
tance, and the coagulum of the blood. 4.
t and oil. 5. Caseine—in milk, with animal
), and in cheese.

atine.—The soft and solid parts of animals
considerable proportion of gelatine, so that
muscles, the skin, the cartilages, the liga-
e tendons, the membranes, or the bones, are
water, a solution is obtained which, on eva-
yields this substance.

es.—Pure gelatine is colourless, inodorous,

and more dense than water. When submitted to a high temperature, it becomes decomposed, yielding plenty of ammonia. It is but slightly soluble in cold water, but is very soluble in hot. It is precipitated by tannin, forming an insoluble compound, which is tanno-gelatine, the basis of leather.

Of Albumen.—Albumen exists in the white of eggs, in the serum of the blood, the chyle, the synovial fluid; in the liquid exhaled by the serous membranes, in fluid of dropsical effusions, in the muscles, &c.

Solid albumen presents the same physical properties as fibrin, and has the same composition. Ammonia and acetic acid dissolve albumen, but not so well as fibrine; soda and potass dissolve it also, and it is again precipitated on the addition of hydrochloric acid. Liquid albumen is transparent, inodorous, more dense than water, more or less viscid; it turns the syrup of violet green, owing to the carbonate of soda which it contains.

Albumen is coagulated by heat, acids, iodine, chlorine, alcohol, tannin, &c. When albumen is submitted to the action of a galvanic battery, it appears in a coagulated form at the positive pole, and soda is found at the negative.

Albumen being capable of decomposing certain metallic compounds, and thereby rendering them less active, is used as an antidote to bichloride of mercury, and sulphates of zinc and copper.

Of the Fibrin.—Fibrin is found in the chyle, in the blood, and it forms the chief part of the muscular substance.

To obtain it, we may beat blood as it issues from the veins with a bundle of twigs. Fibrin soon adheres to each stem, under the form of long reddish filaments, which become colourless by washing them with cold water. It is solid, white, insipid, inodorous, and incapable of affecting the hue of litmus or turmeric paper. By distillation, it yields a large quantity of carbonate

of ammonia, some acetate, a fetid brown oil, and a great proportion of carbon, very brilliant and difficult to incinerate, which contains much phosphate of lime, a little phosphate of magnesia, and some carbonates of lime and soda. Fibrin is insoluble in cold water. Treated with boiling water, it is so changed as to lose the property of dissolving in acetic acid. The liquor filtered from it yields precipitates with infusion of galls, and the residue is white, dry, hard, and of a pleasant taste.

CHIEF PRINCIPLES OF ORGANIC CHEMISTRY.

(*From Liebig.*)

Growth of vegetables; nitrogenized and non-nitrogenized aliment; proteine; albumen, fibrine and caseine; gelatine; theory of respiration and animal heat; digestion; blood; bile; urine; morbid conditions of the urine.

Vegetables consist of two portions:—1st, of carbon, with the elements of water and nitrogen; 2ndly, of earthy salts.

When they are exposed to a high temperature, with free access of oxygen, all the former set of ingredients are *burned;* that is, they combine with oxygen, and escape in the form of carbonic acid, water, and ammonia, whilst the latter set of ingredients remain as *ashes.*

Vegetables derive the former set of ingredients from the atmosphere. This always contains *carbonic acid* and *ammonia,* which become dissolved in the dew and rain, and are absorbed by living vegetables. Under the vital influence, the carbonic acid is decomposed, its oxygen being given off pure to the atmosphere, whilst the carbon, with the elements of ammonia and water, *remains to form* the various structures of the *vegetable.*

The latter set of ingredients is derived from the earth; and no plant, however well supplied with water, carbonic acid, or ammonia, can live in a soil which does not furnish the minerals, which are usually found in its ashes. The *gramineæ* require silica and potass to form the solid framework of their straw; all the seeds of the *gramineæ* and *leguminosæ* (wheat, peas, &c.) contain the phosphates of magnesia, lime, potass, and soda, with the base in excess; all other vegetables contain alkalies in combination with vegetable acids, which are decomposed by a red heat, and leave the alkali in the form of carbonates.

Vegetables constitute the food of animals; being consumed either *directly*, as by graminivorous animals, or *indirectly*, as by the carnivora, which live on the graminivora.

Nutritive substances may be divided into two orders: first, those which contain nitrogen, and which give the elements of blood, out of which the animal organs are built up; secondly, other substances, which contain no nitrogen, and which chiefly serve for *purposes of respiration;* that is to say, to combine with oxygen—in other words, to be *burned*—and so to afford a due supply of animal heat.

The nitrogenized, or real nutritive constituents of food are—vegetable and animal fibrine, vegetable and animal albumen, vegetable and animal caseine.

The non-nitrogenized constituents of food are—fat, starch, gum, sugar, dextrine, bassorine, alcohol, vegetable acids, &c. &c.

Animals, like vegetables, consist of two sets of ingredients,—viz., 1st, of oxygen, hydrogen, nitrogen, and carbon, which form the bulk of most of the organs; and 2ndly, of sulphur, phosphorus, iron, lime, magnesia, and various other alkalies, earths, and metals, *in various* forms of combination. To the latter, Dr. *Prout has* given the name of *incidental* principles.

The three nitrogenized nutritive principles above

ioned,—viz., fibrine, albumen, and caseine, con-
the same elements—carbon, hydrogen, oxygen,
gen,—in nearly the same proportions; albumen
ibrine contain, besides, sulphur and phosphorus,
rmer more sulphur than the latter. Caseine con-
sulphur, but no phosphorus.

When animal or vegetable albumen, caseine, or
e," says Liebig, "are dissolved in a moderately
g solution of caustic potass, and the solution is
ed for some time to a high temperature, the sub-
es are decomposed. The addition of acetic acid
e solution causes, in all three, the separation of a
inous translucent precipitate, which has exactly
ame characters and composition, from whichever
e three it has been obtained."

is substance is called PROTEINE, which may be
ssed by the formula C 48, H 36, N 6, O 14.
proportion *per cent.* in which these four elements
ombined in proteine, and of course, in albumen,
e, and caseine, is about—carbon 55, hydrogen 7,
gen 16, oxygen 22.

has been found that albumen, fibrine, and caseine,
sting as they do of proteine, combined with small
tities of inorganic matters, exist, as has been said
e, ready formed in vegetables; consequently when
into the stomach, they are merely rendered
le, and pass into the blood; and it cannot be said
these three principles are formed by animals,
they exist ready formed in vegetables. Dried
and dried muscular flesh give exactly the same
alents of oxygen, hydrogen, nitrogen, and carbon,
oteine, with about 4 per cent. of ashes.

t there is one abundant animal product—*gelatine*,
is never found in vegetables, nor in the blood,
which differs much from proteine. No proteine
e obtained from it; and it contains much less car-
n proportion to its nitrogen. Its average com-
on per cent. is—carbon 50, hydrogen 7, nitro-

gen 18, oxygen 25. No animal can live on gelatine alone without the other three grand nitrogenous principles.

THEORY OF RESPIRATION AND ANIMAL HEAT.—Between living animal bodies and the oxygen of the atmosphere a perpetual action is going on, which tends to reduce the animal tissues to the same elements which were originally derived from the atmosphere by vegetables—viz., water, carbonic acid, and ammonia.

This constant union of oxygen with the elements of the animal body constitutes a real *combustion*, although a slow one; and the amount of heat given out, and the production of the combustion are the same as if an equal quantity of the same material had been burned in any other way.

This process of oxygenation is natural and necessary; if it be defective, or if it be excessive, disease equally results.

By this process of oxygenation the animal heat is maintained, and every species of animal force generated. As heat is generated by the combustion of carbon in a furnace, and as force is generated by the chemical combinations exerted in a voltaic battery, so animal heat and animal force are dependent on the oxygenation of the active tissue. Without the supply of oxygen, the brain, nerves, and muscles refuse to act; and conversely, every action of brain or muscle is attended with the oxygenation of some part of its tissue, which must be replaced by proper nourishment, else the organ will waste.

First, let us speak of the production of animal heat.

Part of the heat of animals is derived from the oxidation of the nitrogenous tissues, and their conversion into water, carbonic acid, and ammonia; in fact, in carnivorous animals, *all* the heat is derived from this *source*. But in man, and in herbivorous creatures, *most of the* animal heat is derived from the oxidation *of the non-nitrogenized* articles of food specified above.

Oxygen gains access to the body, partly through the skin, but chiefly through the lungs; it enters into combination with the blood, rendering it of a light scarlet (arterial) colour; passes with it to every part of the body; and in the capillaries combines with the carbon and hydrogen of the effete tissues, forming water and carbonic acid. The blood, now rendered black and *venous*, returns to the lungs, where it gives out its carbonic acid, and receives a fresh supply of oxygen.

The temperature of the blood, the frequency of the pulse, and the number of respirations are always in a direct ratio to each other.

By *cold*, the attraction of oxygen for the animal tissues is increased; consequently more food of a carbonaceous character, and more alcohol, are required in cold climates than in warm. Oxygenation is also increased by exercise, which increases the rapidity, and in fact the necessity of respiration. In warmth, and at rest, the waste is very little.

An adult man usually consumes about 14 oz. of carbon, daily, in different articles of food, which is given out by the lungs as carbonic acid. If less carbon is supplied than is necessary, starvation and disease result; if more, the system relieves itself by depositing it in the form of *fat*, which can be stored up in the cellular tissue till it is wanted for combustion in the animal economy.

Fat in the animal economy may be formed by abstracting oxygen from starch or sugar, as may be seen by comparing their composition—*Vide* p. 175, 177. It is enclosed in cells formed of the cellular tissue; many of them are polyhedral.

If carbonaceous food is supplied in excess, and the system does *not* relieve itself by its conversion into fat, then its presence in the blood absorbs the oxygen required for *the oxidation of the* nitrogenous tissues, and *disease results. The blood* becomes charged with urio

acid, urate of soda, or oxalic acid, and gout, gravel, dyspepsia, or inflammations are set up.

Sir B. Brodie has referred the production of animal heat to the nervous system; recent observations do not support this theory, although it cannot be questioned that the animal temperature is influenced by the nervous agency.

DIGESTION.—Food of all kinds, when taken into the stomach, is rendered soluble by the agency of the GASTRIC JUICE, which contains PEPSINE (a portion of the living membrane of the stomach in a state of decomposition); free *muriatic acid*, and *salts*, beside *iron*.* By its influence together with that of the oxygen of the air, which is plentifully swallowed with the saliva,† the solid fibrine &c. of meat, coagulated albumen, and caseine are rendered *soluble*, so that they may enter the blood; but they do not change their composition in other respects.

The pulpy mass of digested food in the stomach is called *chyme*; the liquor extracted from this by the lacteals in the small intestines is called *chyle*, which consists of water holding hydrated albumen and fibrine in solution; if fat has been taken with the food, it is turbid, from the presence of small globules of oil. The chyle is *alkaline*, and coagulates spontaneously.

THE BLOOD.—The BLOOD has a saltish taste, and weak alkaline re-action. Sp. gr. 1·053, to 1·057. Temp. 98°. When it has been drawn for from three to

* Liebig says that the muriatic acid of the gastric juice renders flesh soluble in the same way as it renders the gelatine of bone readily soluble in hot water; *i. e.*, by abstracting the earthy ingredients (phosphate of lime) to which it owes its hardness. The chloride of sodium in the capillaries of the stomach is decomposed; its hydrochloric acid enters the stomach to form the gastric juice; its soda goes to the liver to form bile, and both meet and neutralize each other again in the duodenum, where the bile mixes with the chyme.

† *The saliva* contains water, mucus, some compound of sulphocyanogen, and salts of potass, soda, and lime, especially phosphate of lime.

seven minutes, it coagulates into a gelatinous mass, which gradually contracts into a tough mass or *coagulum*, squeezing out a clear yellowish liquid, the *serum*.

The *coagulum* contains the fibrine, and red particles; which latter contain iron. Under the microscope it is seen to be composed of a number of small round bodies from $\frac{1}{3500}$ to $\frac{1}{3000}$ of an inch in diameter; some are red, the *blood discs* or *corpuscles;* others white, the *white corpuscles*. The iron is supposed to give to the blood its great capacity for attracting oxygen; becoming *per*-oxidized in the lungs, and being reduced to the state of a *proto*xide in the capillaries.

The serum contains water, albumen, and phosphates and chlorides of potassium, sodium, and magnesium. If food of an oily nature has been lately taken, it is thick and milky.

Every organ in the body is undergoing a constant alternation of waste, or oxidation, and of renewal from fresh materials, which by its own vital force it abstracts from the blood. In the process of destruction, the animal tissues undergo a variety of successive changes, which eventually reduce them to the simple forms of water, carbonic acid, and ammonia.

THE BILE.—The two grand organs for getting rid of the effete materials of the tissues are the liver and kidneys. The first eliminates those compounds which are richest in carbon, and the kidneys, those which are richest in nitrogen.

The BILE is a greenish yellow fluid of nauseous odour, and bitter taste, which by chemical analysis has been found to contain a great variety of compounds, chiefly fatty, and carbonaceous; such as cholesterine, resin, picromel, elaic acid, caseine, salts, &c. &c. But the simplest view of its composition is, that it is a compound of a peculiar acid, called *choleic* acid with soda; and *choleic acid is supposed* to be C_{76}, N_2, H_{68}, O_{22}; *i.e., rich in carbon, with* very little nitrogen.

The bile is one of those secretions which is not entirely *excrementitious*, like the urine, but which has its uses. By its soda it neutralizes the chyme, which is rendered acid by muriatic acid, it stimulates the intestines to propel their contents, and then it re-enters the circulation, where its carbon is oxidized, and converted into carbonic acid.

Hence the opinion of chemists is, that in the bile the chief carbonaceous materials derived from the worn-out tissues, as well as the non-nitrogenous constituents of the food, are collected together in a form which is easily convertible into carbonic acid.*

THE URINE.—The nitrogenous or azotized constituents of the effete tissues, as we before said, are expelled by the kidneys, and the first form in which they appear is that of urate of ammonia. If uric acid is thoroughly oxidized, it is converted into carbonic acid and urea; and urea, by spontaneous decomposition, is converted into carbonic acid and ammonia. Thus we have traced the gradual building up of the animal tissues from the carbonic acid and ammonia of the atmosphere, and their reconversion into the same compounds after they have served the purposes of life.

The urine of the human subject is transparent, amber-coloured, and of an aromatic odour, has a saltish taste, and an acid re-action. Its sp. gr. varies from 1·005 to 1·030; in some diseases, particularly in diabetes, it is sometimes as high as 1·050.

Chemists are by no means agreed upon the constituents of urine, and their quantity, of course, varies perpetually according to the specific gravity. Instead of burdening the student's memory, therefore, with tables of numbers which next year may be found incorrect, we will enumerate the leading ingredients, and describe their distinguishing properties.

* *The secretion* of the pancreas gland which is poured into the *intestines with* the bile, is analogous to saliva, but does not con*tain sulphocyanic* acid.

They are—urea, uric and hippuric acids, phosphates, sulphates of alkalies and earths, chloride of sodium, animal colouring matter, mucus of the bladder, and a trace of silica.

Urea is a product of the oxidation of uric acid; for if one atom of uric acid $C_{10} N_4 H_4 O_6$ be combined with 4 atoms of water, and 6 of oxygen, the products are 2 atoms of urea, and six atoms of carbonic acid. Its atomic constitution is $C_2 N_2 H_4 O_2$. It may be regarded as a hydrated cyanate of ammonia, its eq. no. being 60.

1 eq. cyanic acid	= 1 eq. cyanogen and 1 eq. oxygen	= C_2	N O
1 eq. ammonia	=	N	H_3
1 eq. water	=	O	H
		C_2	N_2 O_2 H_4

By heat and moisture it is entirely resolved into carbonate of ammonia; its nitrogen being converted into ammonia by hydrogen, and its carbon into carbonic acid by oxygen.

Urea may be obtained by evaporating recent urine to the consistence of a syrup, and precipitating the urea by nitric acid. The nitrate of urea thus formed is decomposed by carbonate of potash, after which, the liquid is to be concentrated, and the nitrate of potash removed by crystallization. It is then decolorized by animal charcoal, dissolved in water, which is afterwards evaporated, and redissolved in boiling alcohol, which yields pure urea by evaporation.

Urea is colourless, very soluble in water and alcohol, and capable of crystallizing in four-sided transparent pearly prisms. It is deliquescent if exposed to a moist atmosphere. It is fusible at 248°; at a somewhat higher temperature, it is decomposed. When urea is given internally, it acts as a powerful diuretic.

Uric acid.—Uric, or lithic acid, may be obtained from the *sediment of human* urine, or from the urine *of birds and serpents,* by dissolving the evaporated

urine in warm water, filtering the solution, and precipitating by means of hydrochloric acid. Uric acid is white, pulverulent, tasteless, and reddens moistened litmus paper. It is insoluble in alcohol and ether, and only dissolves in 1700 times its weight of boiling water. Its composition has been given above, and its tests will be mentioned presently.

Hippuric acid may be obtained by evaporating urine to the consistence of syrup, precipitating by muriatic acid, and then adding ether, which dissolves the hippuric acid. Its composition is $C_{18}\ H_8\ N\ O_5$, or per cent., carbon 60·5, hydrogen 5, nitrogen 8, oxygen 26·5. It appears in the form of long shining, transparent, four-sided obliquely truncated prisms. At a high temperature it fuses, and on increasing the heat, decomposes into an oil, benzoic acid, and carbon. It also dissolves in hot nitric acid, and yields, on cooling, crystals of benzoic acid.

The *phosphates* are said by Liebig to be naturally those salts which were contained in flesh and grain used as aliment, and which are not wanted for the purposes of the economy. The phosphates of soda have an alkaline re-action, and are the cause of the alkaline reaction of the chyle and blood, and these, with a certain amount of phosphate of lime and magnesia, are excreted with the urine, where, by their alkaline qualities, they render the uric acid soluble. If ammonia is generated in the urine, it combines with the phosphate of magnesia, forming the *triple phosphate*, of which more hereafter.

The sulphates are owing to the oxygenation of that sulphur in the economy, which is consumed in various articles of food; and the sulphuric acid so formed unites with part of the bases of the phosphates.

Chloride of sodium is derived from the food.

Liebig has shown that if vegetables are taken *largely as* articles of food, they, through the alkaline *salts they* contain, communicate an alkaline quality

to the urine, which is perfectly consistent with health.

DISEASED CONDITIONS OF THE URINE. — Since the urine contains most of the soluble debris of the tissues, a knowledge of its diseased condition is valuable, inasmuch as it gives the key to any diseased transformations or conditions of the blood or living tissues.

Lithic sediments. Lithate of ammonia.—This salt very commonly is in excess, particularly after feverishness, cold, indigestion, &c. It forms a reddish brown sediment, deposited as the urine cools, and distinguished by dissolving again if the urine is heated.

Lateritious sediment.—That dark-red sediment which stains the sides of the chamber vessel of a brick-dust colour, consists of lithate of ammonia with a red colouring matter, which has been called *rosacic acid*, and on the nature of which, chemists are by no means agreed. There is one variety of this, a *pink* sediment, deposited where there is serious organic disease of the liver or other part.

Lithic or uric acid gravel. — The urine very acid, of a bright copper colour, and depositing crystals of lithic acid, red like cayenne pepper.

Oxalate of lime.—Liebig has shown that oxalic acid may be formed by the imperfect oxygenation of uric acid, which is converted into urea, and *oxalic* instead of *carbonic* acid. This acid uniting with lime, appears in the urine in the form of minute crystals, which may be detected by the microscope; or they may concrete into a calculus. Small oxalate of lime calculi are called *hempseed*, larger ones, *mulberry* calculi.

Phosphate of lime.—This proceeds from the mucus of the bladder, when it is secreted in unusual quantities.

SPECIES.	EXTERNAL CHARACTERS.	CHEMICAL COMPOSITION.	REMARKS.
1. Uric Acid	*Form*, a flattened oval, *sp. gr.* generally exceeds 1·500; *colour*, brownish or fawnlike: *surface* smooth; *texture*, laminated.	It consists chiefly of *uric acid*: when treated with nitric acid, a beautiful pink substance results. It is insoluble in water, very soluble in the pure alkalies.	It is the prevailing species; the surface sometimes occurs finely tuberculated. It frequently constitutes the nuclei of other species.
2. Mulberry Oxalate of lime.	*Colour*, dark brown; *texture*, *hard*; *sp. gr.*, from 1·428 to 1·976; *surface*, studded with tubercles.	It is *oxalate of lime*, and is decomposed in the flame of a spirit-lamp, swelling out into a white substance, which is *quick lime*.	This species includes some varieties which are smooth and pale coloured, resembling a *hemp seed*.
3. Bone Earth	*Colour*, pale brown, or grey; *surface*, smooth and polished; *structure*, laminated, the laminæ easily separating into concrete crusts.	Principally *phosphate of lime*. It is soluble in hydrochloric acid.	Rare.

	less compact than the preceding species; between its laminæ small cells occur, filled with shining particles.	alkalies decompose it, setting free the ammonia.	
5. Fusible	*Colour*, greyish white.	A compound of the two foregoing species.	It is very fusible, melting into a vitreous globule.
6. Cystic Oxide	Very like the triple calculus, but it is unstratified, more compact, and homogeneous.	It consists of *cystic oxide*; under the blowpipe it yields a peculiarly fetid odour. Is soluble in acids and in alkalies, even if they are fully saturated with carbonic acid.	It is a rare species.
7. Alternating	Its section exhibits concentric laminæ.	Compound of several species, alternating with each other.	
8. Compound	No characteristic form.	The ingredients are separable only by chemical analysis.	

Triple phosphate.—This is a phosphate of magnesia and ammonia, supposed to be formed through the decomposition of urea, which generates ammonia, which unites with the soluble phosphate of magnesia, and converts it into the insoluble phosphate of ammonia and magnesia. The urine is generally pale, whey-like, and alkaline, and the minute crystals of this salt form an oily-looking scum on its surface.

Fusible calculus.—This is composed of the two preceding kinds of phosphates mixed.

Excess of urea.—This constitutes the disease called diabetes insipidus, in which the tissues seem to have too little vitality, so that the oxygen of the atmosphere speedily converts them into urea. The sp. gr. of the urine is high, its quantity large; and on adding a little strong nitric acid to a little of the urine in a watch-glass, a spontaneous crystallization of nitrate of urea takes place within half an hour.

Sugar.—*In diabetes mellitus* there is such a lack of vital energy, that the food seems to be transformed into a form of sugar like that of grapes, which appears abundantly in the urine, and may be made to ferment by yeast, which is an excellent test of its presence. The sp. gr. and quantity of the urine are both very great.

Albumen. — In Bright's disease of the kidney (*granular degeneration*), acute dropsy, and some other diseases, albumen appears in the urine, where it may be detected by *boiling* and *adding a few drops of nitric acid*, which cause it to coagulate.

Blood is found in the urine in various diseases of the kidneys and bladder, it may be coagulated by boiling.

Bile is present in jaundice, making the urine of a dark porter colour, and capable of being turned green by muriatic acid.

Prostatic calculi consist essentially of phosphate of lime and animal matter, and in a few instances the latter is present in considerable abundance, so as even

to retain the original shape of the concretion after the earthy matter has been removed by an acid.

Gouty Concretions are composed of urate of soda.

The calculi found sometimes in the pineal, prostate, salivary, and bronchial glands, in the corpora cavernosa penis, and between the muscles, appear to be phosphate of lime.

The Tartar which collects on the human teeth is composed of earthy phosphates, with a little animal matter.

Biliary Calculi are composed of either cholesterine, adipocere, or inspissated bile.

Lymph.—According to Chevreul, 1000 parts of the lymph of a dog contained 926·4 of water, 61·0 of albumen, 4·2 of fibrin, 6·1 of chloride of sodium, 1·8 of carbonate of soda, 0·5 of phosphate of lime, phosphate of magnesia, and carbonate of lime.

Saliva.—Usually alkaline, contains albumen, ptyalin, and sulphocyanide of potassium, sp. gr. 1002 to 1009.

Synovia.—According to Margueron, 100 parts of synovia contain 80·46 of water, 4·52 of albumen, 11·86 fibrous matter, 1·75 of chloride of sodium, 0·70 of carbonate of soda, 0·70 of phosphate of lime.

Aqueous Humour.—This fluid is composed of water, chloride of sodium, lactate of soda, soda, an animal matter soluble only in water, and a little albumen.

Tears.—According to Fourcroy and Vauquelin, the tears are composed of a large quantity of water, mucus, chloride of sodium, and of phosphates of lime and soda.

Perspiration.—By the skin is thrown off water; lactic, acetic, and carbonic acids; lactate of ammonia; hydrochlorate of ammonia; chloride of sodium; nitrogen, a little earthy phosphate; a trace of oxide of iron; and an inappreciable quantity of animal matter.

Milk.—According to Berzelius, 1000 parts of skimmed *cow's milk*, whose sp. gr. was 1·033, contained 928·75 of *water*, 28·000 of *caseous matter*, with a trace *of butter*, 35·00 *of sugar of milk*, 1·70 of chloride of

potassium, 0·25 of *phosphate of potash*, 6·00 of *lactic acid* and *acetate of potash*, with a trace of tartrate of iron, and 0·5 of *phosphate of iron*. The cream, whose sp. gr. was 1·024, yielded in 100 parts 4·5 of butter, 3·5 of caseous matter, and 92·0 of *whey*, containing 4·4 of *sugar of milk, and various salts:* 100 parts of the *caseous matter* gave by incineration 6·5 of ashes, consisting of an earthy phosphate and *pure lime*. Woman's milk contains less caseine and more sugar. Under the microscope milk is seen to consist of a transparent fluid, in which a number of transparent globules float about. These consist of fat, surrounded by an albuminous envelope, which forms the cream; the capsules being ruptured, the fatty portions form *butter*.

Brain.—The brain consists of a peculiar fatty acid, called the cerebric, in combination with soda; of albumen, a large quantity of phosphorus, salts, and water.

Muscle.—Muscular substance contains fibrin principally with chlorides of potassium and sodium; phosphates of lime and soda; oxide of iron; and, according to some, sulphur, and oxide of manganese.

Bones.—Bones are composed of gelatine, phosphate, and carbonate of lime, phosphate of magnesia, fluoride of calcium, soda, chloride of sodium, with traces of alumina, silica, oxide of iron, and of manganese. Schreger states, that in the bones of a child the earthy matter constitutes one-half, that in the bones of the adult it amounts to four-fifths, and in those of an old person to seven-eighths, of the whole mass. The enamel of the teeth does not contain quite 2 per cent. of animal matter, and has neither free soda nor chloride of sodium as constituents. It is composed of the phosphate, carbonate, and fluate of lime.

The *crystalline lens* is composed of albuminous matter, water, osmazome, alcoholic extract with salts, *watery* extract with traces of salts, and animal matter *insoluble in* water. The ash left after incineration is *said to contain* iron.

Difference between Pus and Mucus.—Pure pus is a thick creamy liquid, and pure mucus very viscid; but when mucous membranes are inflamed, they secrete a *purulent mucus*, which partakes of the characters of both pus and mucus; having the viscidity of the one, and the innumerable microscopic globules of the other.

FERMENTATION.—This is a process by which organic substances resolve themselves into simpler compounds preparatory to their ultimate resolution into water, carbonic acid, and ammonia.

Fermentation has received several names, according to the results of the process. Thus, we speak of the *saccharine fermentation*, whereby starch or lignin is converted into sugar; of the *vinous* fermentation, whereby sugar is converted into alcohol; of the panary fermentation, which is merely the conversion of a small portion of starch into sugar, and of sugar into alcohol in making bread; of the *acetous* fermentation, whereby alcohol is converted into vinegar, and of the *putrefactive*, whereby a nitrogenized body is resolved into offensive gases, as a step preparatory to oxidation.

There are certain substances called *ferments*, which are capable of exciting fermentation in saccharine and alcoholic substances. They consist of substances which are themselves in a state of *transformation*, or *oxidation*, which *state* they communicate to other bodies with which they come in contact. Yeast, which consists of the glutine from malt in a state of oxidation; the inner membrane of the stomach and bladder, and nitrogenous matters generally in a state of decay, have this property.

The *saccharine* fermentation occurs in the ripening of fruits, the process of germination, malting, &c. The gluten of the barley being acted on by the oxygen of the air, together with heat and moisture, communicates to the starch the faculty of absorbing more water, whereby it is *converted into gum* and sugar.

The vinous fermentation is set up when a liquid con-

taining sugar and a *ferment* is kept at a temperature about 60° or 70°. The access of air is not necessary. The elements of sugar, *split* into nearly equal weights of alcohol and carbonic acid. Sugar contains equal equivalents of oxygen, hydrogen, and carbon. Take six equivalents of each:

Sugar.		Alcohol.		2 eq. Carbonic Acid.
6 Carbon ..... 36 6 Hydrogen... 6 6 Oxygen 48	=	4 Carbon ..... 24 6 Hydrogen... 6 2 Oxygen 16	+	2 Carbon .....12 4 Oxygen.....32

The *acetous fermentation* consists in the oxidation of alcohol; and when it occurs in its simplest form, it seems to depend on the addition of four eq. of oxygen to one of alcohol.

Alcohol.		Acetic Acid.		3 eq. Water.
4 Carbon ..... 6 Hydrogen... 2 Oxygen	+4 Oxygen =	4 Carbon ..... 3 Hydrogen... 3 Oxygen	+	3 Hydrogen. 3 Oxygen.

The eq. of acetic acid is 51.

This fermentation readily proceeds where a weak alcoholic liquor containing a ferment is exposed to the air, at a temperature from 60 to 100; but it is checked by a low temperature.

Panary fermentation.—Wheat flour is mixed with yeast and water; part of its starch is converted into sugar, and the sugar into alcohol and carbonic acid gas, and this gas being given off in every part of the dough, renders it a light, spongy mass, easily permeable by water, and much more digestible than a heavy doughy mass.

Putrefaction.—This gives rise to an infinite variety of compounds of hydrogen with sulphur, phosphorus, and carbon, and of these gases with portions of offensive and not quite decomposed animal matter. These are exhaled into the atmosphere, where they are oxi*dized.* Putrefaction is prevented by—1st, a low tem*perature under* 40°; 2ndly, by absence of moisture; *chloride of lime*, common salt, and alcohol, which ex-

t the water from organic substances, hinder their efaction; 3rdly, the exclusion of air, if effected re any decomposition has begun, or if the substances) been exposed after exclusion of air to a high tem- ture; 4thly, by empyreumatic oils, such as creosote, ily and acid substances contained in *wood smoke*, &c. [any eminent chemists consider that there is but form of fermentation, and that the preceding are so ogous as not to call for a distinct consideration. *remacausis* is the name given by Liebig to a slow ation of the carbon and hydrogen of organic sub- ces, whereby they are converted into water, car- c acid, and ammonia. It is derived from two k words, *erema—causis*, signifying *slow combus-* . Putrefaction is their breaking up into other pounds previous to oxidation.

PART III.

ARMACEUTICAL DECOMPOSITIONS.

.—This Part is intended to be read by the student, with the Pharmacopœia in his hand.

ACIDS.

TUM DESTILLATUM.—Vinegar consists of acetic , water, mucilaginous matter, a little alcohol, en, sugar, extractive matter, frequently malic and aric acids; and in this country the law allows one of sulphuric acid to be added to every 1000 parts inegar. The volatile ingredients of vinegar are, hol, pyro-acetic spirit, acetic acid, and water. en seven pints of vinegar out of a gallon are dis- l over, the *process must* be stopped, lest some of *heavier impurities should* pass over.

Many vegetable juices, containing saccharine matter, which have not undergone the vinous fermentation, will pass at once into the acetous. However, the vinegar obtained from wine is stronger than that obtained from liquors merely saccharine. *White* wines yield the strongest vinegar. The strongest malt vinegar is termed *proof vinegar*, and is calculated to contain 5 per cent. of real acid. Vinegar should be distilled in glass vessels. One fluid ounce of vinegar should saturate one drachm of crystallized carbonate of soda.

Properties.—Distilled vinegar should be colourless, and should be totally vaporized by heat. No precipitation should be produced either by the addition of acetate of lead, nitrate of silver, or iodide of potassium. Its colour should not be affected by the addition of ammonia or of hydrosulphuric acid. If silver leaf be digested in it, there should be no precipitation on the addition of hydrochloric acid. 100 gr. of distilled vinegar should saturate 13 gr. of crystallized carbonate of soda.

There being no precipitates yielded on adding the above reagents, proves the absence of sulphuric or hydrochloric acids, lead, tin, or other metallic impregnations. There being no precipitate thrown down on digesting silver leaf first, and then adding hydrochloric acid, proves the absence of nitric acid.*

Officinal Preparations.—Acetum colchici—acetum scillæ, oxymel scillæ—liquor ammoniæ acetatis.

Medicinal Uses.—Dilute acetic acid is sometimes employed as a refrigerant, mixed with any diluent, in fevers; but for this purpose common vinegar is pre-

* It may be as well to state, once for all, that acetate of lead is added usually as a test for sulphuric acid and sulphuretted hydrogen, the former of which yields a white, and the latter a black precipitate. Nitrate of silver is a test for common salt, or *any other* chloride, or for hydrochloric acid. Iodide of potassium *is a test for* most of the metals. Ammonia would also pre*cipitate most of* the metals, and hydrosulphuric acid would pro*duce a black* precipitate with any salt of lead.

as its flavour is more agreeable. It is admi-
d in hæmorrhage, especially with the acetate of
a it increases the solubility of that salt. When
led on the floors of the chambers of those affected
hoid fevers, its odour has been found grateful;
is also supposed to counteract the contagious
s. Externally, it is used as a fomentation to
or sprains; and its vapour is inhaled with benefit
ignant sore throat. This acid was formerly sup-
to possess some antinarcotic effect, and was
re administered in those cases in which opium
ken in a poisonous dose; the experiments of
however, prove that the exhibition of acids is
injurious than otherwise, until the opium has
ot rid of by vomiting or by the stomach-pump,
r increase the solubility of the morphia.

DUM ACETICUM.—*Ingredients.*—Acetate of soda,
ric acid, distilled water.

sulphuric acid unites with the soda, forming a
te of soda, and the acetic acid thus set free is
ted by distillation, an anhydrous sulphate of
emaining in the retort. Too much heat must
e applied, as it may decompose the sulphate of

acetate of soda directed to be used in the above
s is prepared in the following manner:—By ex-
wood to heat in iron vessels, watery vapour and
mable gases are disengaged, and the residue is
al. The products collected in the receiver con-
f pyroxilic spirit, tar, oily matter, and weak
acid. The tarry matter is then removed, and
s added until the acid fluid is saturated; on
ing heat to this, the pyroxilic spirit is driven off.
e solution of acetate of lime thus formed, sul-
of soda is added as long as any precipitate ap-
; sulphate of lime is thrown down, and acetate
la remains *in solution.* The acetate of soda is
vaporated to dryness, and any remaining impu-

rities which it may still retain are in a great measure decomposed by heating it to about 540°. By dissolving it in water, filtering, and evaporating, the charred matter is removed.

Properties.—Strong acetic acid is liquid and colourless, and has a pungent and agreeable smell. It reddens litmus paper, and forms neutral salts with the alkalies. It volatilizes at a low temperature, giving out an inflammable vapour, which burns with a white light. In its concentrated state, it crystallizes when exposed to a low temperature; hence the term *glacial acetic* acid. It oxidizes zinc, copper, lead, iron, and some other metals. It dissolves the volatile oils, camphor, and the alkaloids. Its sp. gr. is 1·048, and 100 gr. neutralize 87 of crystallized carbonate of soda.

Impurities.—Sulphurous, sulphuric, or hydrochloric acids may be detected by acetate of lead, which gives a white precipitate. If it contain copper, an excess of ammonia will render it blue. Lead may be detected by passing hydrosulphuric acid through it, a black precipitate being produced. On evaporation, pure acetic acid should leave no residue.

Anhydrous acetic acid is composed of O_3 H_3 C_4 and its equivalent number is 51.

Dr. Williamson assumes in acetic acid a peculiar radical which he terms othyl, C_4 H_3 O_2; *i.e.*, othyl in which 2 eq. of H are replaced by 2 of O. The constitution of acetic acid thus becomes analogous to that of benzoic acid, in which Liebig and Wöhler assume a peculiar radical benzoyl, C_{14} H_5 O_2.

The strongest acetic acid is composed of 1 atom of anhydrous acid = 51, and 1 atom of water = 9; equivalent 60.

Officinal Preparations. — Acetum Cantharidis—Potassæ Acetas—Morphiæ Acetas—Plumbi Acetas, Oxymel.

Medicinal Uses.—Vide Acetum Destillatum.

Acetum Cantharidis (Epispasticum).—Two ounces

harides are macerated for eight days in a pint
ic acid, by which a considerable portion of
ctive matter is taken up. This preparation
found useful where it is desirable to produce
sication. It is unfit for internal administration.

UM COLCHICI.—An ounce of fresh colchicum
is macerated in sixteen fluid ounces of distilled
, by which a solution of *acetate of colchicia* is
d. An ounce of weak spirit is added to prevent
osition taking place.

icinal Uses. — Vide MATERIA MEDICA, Art.
CUM.

UM SCILLÆ.—The distilled vinegar dissolves
ive matter of the squill, and the spirit is added
ent decomposition.

icinal Uses.—Diuretic, expectorant, and emetic;
such is given in dropsies, asthma, and chronic
. Dose f ʒss. to f ʒij.

UM BENZOICUM (Bz O, H O).—On the applica-
heat as directed in the Pharmacopœia, the ben-
id sublimes, and condenses in a cool part of the
tus. This process is the most productive; the
acid obtained by it, however, is contaminated
me empyreumatic oil, which is formed by the
osition of a portion of the resin. Hence it is
d to be pressed between folds of bibulous paper;
owever, does not completely remove the oil.
ling to Mr. Brande's experiments, a pound of
yields two ounces of the acid.

oic Acid is also obtained by boiling benzoin with
hus separating the benzoic acid from the resin;
ate of lime is formed which is very soluble.
hloric acid is next added to the benzoate of
a hydrochlorate of lime is formed, which re-
in solution, and the benzoic acid is precipitated.
washed frequently, to remove any adhering
hlorate of lime, and it is then sublimed to purity
letely from any saline or extractive matter

which may remain. The benzoic acid obtained by this process is very pure. A large quantity of crystallized benzoic acid is sublimed by digesting benzoin in sulphuric acid.

Properties. — Pure benzoic acid crystallizes in feathery crystals, of a silky appearance and nearly snowy whiteness. Its odour is fragrant, which is owing to the presence of some essential oil. It may, however, be obtained perfectly inodorous, by dissolving the acid in alcohol, and adding water, which precipitates it. At 230° it fuses, and sublimation commences. It is sparingly soluble in cold water, but dissolves in 24 times its weight of boiling water. It should be perfectly soluble in alcohol, and but sparingly so in water; it should also be soluble in a solution of lime of potash, and be precipitated from such solutions by the addition of hydrochloric acid. Anhydrous benzoic acid is composed of $H_5 O_2 C_{14} = 113$. Crystallized acid contains 1 atom of water = 9. Equivalent 122.

Wöhler and Liebig consider benzoic acid to be the oxide of a compound inflammable body, which they call *benzule* or *benzayl.*

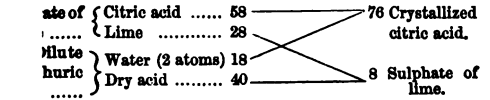
Officinal Preparation.—Tinctura Camphoræ composita.

Medicinal Uses.—Benzoic acid has expectorant properties. Dr. M. Baillie used to give a pill composed of two grains of benzoic acid, and three of extract of poppy, in certain cases of tracheal irritation and asthenic cough. But this acid is chiefly used in modern practice to influence the secretion of urine. It has been used in gout, and other complaints attended with red acid sediments from the urine, with a view of rendering the uric acid more soluble, and perhaps of converting it into the *hippuric acid.* For this purpose it is generally *given in* combination with ammonia; 10 gr. of benzoic *acid and 5 of* carbonate of ammonia dissolved in dis*tilled water,* and taken three times a day. Also in the

hatic diathesis with alkalescent urine in doses of
ains *per se.*

DUM CITRICUM (C_{12} H_5 O_{11}). — *Ingredients.* —
n Juice, Prepared Chalk, Diluted Sulphuric
Distilled Water.

arks.—*Lemon juice* consists of citric acid, com-
with water, vegetable mucilage, and the paren-
tous parts of the fruits. To remove these latter
ities, which prevent the crystallization of the
is the object of the present process. On adding
(carbonate of lime) to the lemon juice, an
ble citrate of lime is formed, and the car-
acid escapes with effervescence. By frequently
ng the citrate of lime with water, any adhe-
mucilage is removed. When the citrate of lime
btained is boiled with dilùted sulphuric acid,
ulphuric acid unites with the lime, forming
phate of lime, and citric acid remains in solu-
This decomposition is shown in the annexed
am:



filtering and evaporating this solution, crystals
btained, which are purified by repeated solution,
tion, evaporation, and crystallization.

operties.—Pure citric acid is colourless and in-
ous, has a sharp and rather caustic acid taste, and
ens deeply the vegetable colours. It crystallizes
omboidal prisms; it is soluble in less than its own
ht of water, at 60°, and boiling water dissolves
ly twice as much; it is also soluble in alcohol. In
y and warm air it seems to effloresce; but when
air is *damp, the crystals* absorb water.

e *next table shows* the equivalent proportions of

concrete citric acid and lemon juice necessary for the neutralization of alkaline salts :—

A scruple of	*Citric Acid.*	*Lemon Juice.*
Bicarbonate of Potash	gr. 14	f ʒiijss.
Carbonate of Potash	gr. 17	f ʒiiij.
Sesquicarbonate of Ammonia ...	gr. 24	f ʒvj.

Nine drachms and a half of citric acid, dissolved in a pint of distilled water, give a solution equivalent in strength to lemon juice.

The proportion of water in crystallized citric acid is very variable ; it sometimes consists of one of the dry acid and one of water, and occasionally one of the acid and one and one-third equivalents of water. According to Berzelius, crystallized citric acid is composed of 79 per cent. of real acid and 21 of water.

Anhydrous citric acid is composed of C_{12}, H_5 O_{11} Carbon $6 \times 12 = 72$; Hydrogen $1 \times 5 = 5$; Oxygen $8 \times 11 = 88 = 165$.

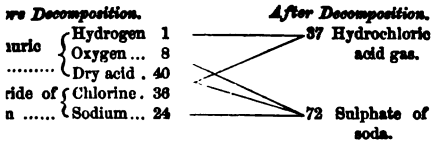
Impurities.—If it contain any sulphuric acid, or crystallized sulphate, the solution will yield a white precipitate, on the addition of chloride of barium, or acetate of lead, which is not dissolved by boiling nitric acid. Tartaric acid may be detected by slowly adding a solution of a salt of potash, minute crystals of bitartrate being deposited if it contain any of that acid. Citric acid should be completely dissipated by heat.

Medicinal Uses.—Lemon juice is a grateful refrigerant in febrile affections ; it has long been celebrated as an anti-scorbutic ; and is supposed to act chemically by imparting oxygen to the system. It relieves

or vomiting, if given in an effervescing draught, has been recommended in the phosphatic dia-

ɔUM HYDROCHLORICUM (H_1 Cl_{36})—*Ingredients.* ride of Sodium, Sulphuric Acid, Distilled

arks.—When liquid sulphuric acid is added to oride of sodium, its water is decomposed; its ı with the sodium forms soda, which uniting ıe sulphuric acid, forms sulphate of soda; the en with the chlorine forms hydrochloric acid ıich combining with the water used in diluting, ıto the receiver. A portion of the sulphate of converted into a bisulphate by combining with ess of sulphuric acid employed in this process. ınexed diagram explains the nature of these s:—



rochloric acid gas may also be formed by deto- equal measures of hydrogen and chlorine; no sation of volume, however, attends the combi- ; and two measures of hydrochloric acid gas ned.

ıerties.—When pure, hydrochloric acid is colour- ı taste is sour and acrid, it turns the vegetable ed, it emits copious greyish white fumes when ı to the air. Its sp. gr. should be 1·160. The ient of hydrochloric acid is 37, and it is com- of 1 atom of hydrogen 1, 1 atom of chlorine eight of its atom 37.

synthetical composition of this acid may be

shown by detonating, as before mentioned, the two gases. *Analytical* proof may be procured by heating the acid gas over binoxide of mercury; the products being bichloride of mercury and water. Or, by heating potassium, tin, or zinc, in contact with this gas, over mercury, one-half its volume disappears, and the residue is pure hydrogen. On examining the substance formed, it is found to be a chloride of the metal employed.

Impurities.—Hydrochloric acid has commonly a greenish-yellow colour, owing to the presence of either chlorine, peroxide of iron, or nitric acid. The chlorine may be detected by its smell, or by its dissolving gold leaf, on which pure hydrochloric acid has no effect. Peroxide of iron, or most other metallic oxides, would be detected by adding ammonia in excess to the dilute acid; if the peroxide of iron be present, it is precipitated of a reddish colour. Sulphuric acid is discoverable by adding chloride of barium to the acid, previously diluted with five or six times its bulk of distilled water. When 100 parts of this acid saturate 132 of carbonate of soda, it contains more than 33 per cent. of acid gas. When evaporated from a capsule of glass or platina, it should leave no residue.

Officinal Preparations.—Acidum Hydrochloricum Dilutum, Antimonii Potassio-tartras, Tinctura Ferri Sesquichloridi, Ferri Ammonio-chloridum.

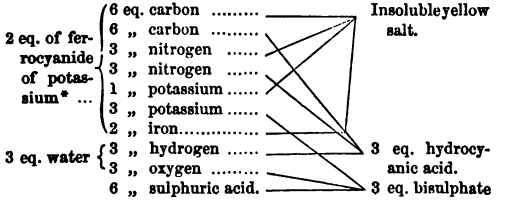
ACIDUM HYDROCHLORICUM DILUTUM is formed by mixing 4 parts of hydrochloric acid with 12 of distilled water. *Dose,* 10 to 30 minims in barley-water.

Medicinal Uses.—In malignant typhus and scarlatina, as an antiseptic and febrifuge, but it should be accompanied by cathartics. In scarlatina it is used, largely diluted, as a gargle. As a lithontriptic, it is administered in those cases in which there is a deposition of the earthy phosphates; in such cases it is supposed to act both by strengthening, and also by its chemical

influence on the urine. It has been employed to neutralize contagious effluvia; its disinfecting power, however, is inferior to that of chlorine gas or nitrous acid.

ACIDUM HYDROCYANICUM DILUTUM (H Cy).—*Ingredients.*—Ferrocyanide of Potassium, Sulphuric Acid, Distilled Water.

The simplest way of stating the changes that occur is as follows:—Ferrocyanide of potassium is a double salt, composed of 1 eq. cyanide of iron, and 2 eq. cyanide of potassium: the cyanide of iron playing the part of an acid, and the cyanide of potassium that of an oxide. On adding sulphuric acid this compound is separated; the cyanide of iron falls as a precipitate, whilst cyanide of potassium is decomposed. Its cyanogen taking hydrogen from the water, becomes *hydrocyanic acid;* its potassium takes the oxygen of the water, and becomes potassa, which uniting with the sulphuric acid, forms a bisulphate of potassa.


2 eq. of ferrocyanide of potassium* ...
6 eq. carbon .....
6 „ carbon .....
3 „ nitrogen .....
3 „ nitrogen .....
1 „ potassium .....
3 „ potassium .....
2 „ iron.....
3 eq. water
3 „ hydrogen .....
3 „ oxygen .....
6 „ sulphuric acid.
Insoluble yellow salt.
3 eq. hydrocyanic acid.
3 eq. bisulphate of potash.

In the second process directed by the Pharmacopœia, the hydrogen of the hydrochloric acid unites with the cyanogen of the cyanide of silver, and forms hydrocyanic acid. The chlorine combines with the silver, forming an insoluble chloride of silver, which is precipitated, and from which the dilute hydrocyanic acid is poured off.

* *Everitt—Phil. Magazine*, Feb. 1835.

Besides these two processes directed by the Pharmacopœia, there are numerous others. Vauquelin's process consisted in passing hydrosulphuric acid through a tube containing bicyanide of mercury; the products in this case being hydrocyanic acid, and bisulphuret of mercury. Another method of obtaining this acid is, by mixing bicyanide of mercury and hydrochloric acid, and distilling; 2 eq. of hydrocyanic acid pass over, and 1 eq. of bichloride of mercury remains. A third consists in decomposing cyanide of potassium, by means of tartaric acid and distilled water. For this purpose, 72 gr. of tartaric acid, 32 grs. of cyanide of potassium, and 1 oz. of distilled water, should be employed. The tartaric acid should first be dissolved in a phial, with a cork or stopper well fitted to it; the cyanide of potassium should then be added, and the bottle be immediately stopped. The phial should be kept some time in cold water, in order to repress the heat which is produced as the result of the chemical action; and when all action has ceased, it should be put aside for twelve hours to allow the bitartrate of potass to subside. In this process the water becomes decomposed; its hydrogen unites with the cyanogen, forming hydrocyanic acid; its oxygen combines with the potassium, forming potass, which unites with the tartaric acid, forming a bitartrate of potass, which is deposited.

Properties.—It is a colourless liquid, having a strong odour; its taste is at first cooling, but it soon becomes hot and irritating. It is very volatile, and evaporates rapidly when exposed to the atmosphere; it boils at about 80°, and freezes at zero. It combines with alcohol and water in all proportions. It has but a feeble affinity for salifiable bases, being even displaced by carbonic acid.

Hydrocyanic acid is composed of 1 cyanogen (C_2N) and 1 hydrogen; and its equivalent number is 27.

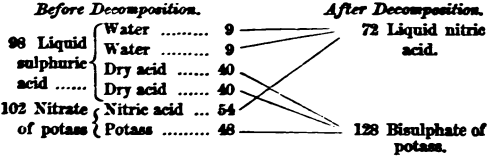
Impurities.—Should this acid not be perfectly volatilizable, it is impure. Metallic impregnations may be detected by hydrosulphuric acid. By nitrate of silver, the proportion of real acid present is estimated; 100 gr. of this acid should yield a precipitation of 10 gr. of cyanide of silver, which, being soluble in hot nitric acid, is easily distinguished from the chloride. Should the iodo-cyanide of potassium and mercury be reddened on its addition to hydrocyanic acid, some other acid is present, which decomposes the iodo-cyanide of potassium, and forms biniodide of mercury. The Pharmacopœial acid contains 2 per cent. of real acid; Scheele's acid, which is often used, contains 5 per cent.

Medicinal Uses.—This acid is a powerful sedative, useful in cases of catarrh, asthma, pertussis, and in phthisis, more especially in its first stage; in cases of hypertrophy of the heart, when it is associated with, or aggravated by, an irritable condition of the stomach; in all forms of dyspepsia, especially when dependent on an irritable state of the nerves of the stomach. It acts more particularly on the nervous system than on any other, its influence on the heart being very slight. It has also been recommended in hæmoptysis, dysmenorrhœa, floodings, &c., and has been employed as an external application in impetiginous affections. *Dose,* ɱij. to ɱviij., in any proper vehicle.

ACIDUM NITRICUM (NO_5 Eq. 54).—*Ingredients.*—Dried Nitrate of Potash, Sulphuric Acid.

Remarks.—In this process, two atoms of sulphuric acid are employed to each atom of nitrate of potass. Every two proportions of sulphuric acid consist of two equivalents of water (18), and two of dry acid (80); and the nitrate of potassa is composed of one atom of nitric acid (54), and one atom of potassa (48). The dry sulphuric acid unites with the potassa, forming a bisulphate *of potassa; the nitric* acid, combining with *the two atoms of water of the* sulphuric acid, passes

over, and is condensed in the receiver. The annexed diagram represents these changes:—



If the sulphuric acid be employed in less than the above proportions, two sources of inconvenience arise:—The acid obtained is always of a deep colour, owing to its containing much nitrous acid, as nitric acid cannot exist in the liquid form apart from two atoms of water; and if there be less than this quantity of water, it is decomposed into oxygen and nitrous acid. *Secondly.* If but one atom of sulphuric acid is employed, a sulphate of potass is formed, which, on cooling, becomes very hard, and presents a source of difficulty to remove it without breaking the retort.

Properties.—Liquid nitric acid is a dense colourless fluid, which emits copious white fumes on exposure to the air. It is highly corrosive; and the skin is permanently stained of a yellow colour by it. With alkalies it forms neutral salts, which are called *nitrates.* In its purest and most concentrated form it is colourless; and has a sp. gr. of 1·50 or 1·510. Nitric acid attracts watery vapour from the atmosphere, and its sp. gr. becomes diminished. Its combination with water is attended by condensation, and the evolution of heat. Nitric acid boils at 248°, and distils unaltered; and the strongest acid freezes at about 50° below zero. This acid has generally a tinge of yellow, owing to the presence of a portion of nitrous acid, formed by *the decomposition* of a minute portion of the nitric *acid during its* production. Nitric acid oxidizes nearly *all the metals,* especially copper, tin, lead, mercury,

ıe, nitric oxide gas being evolved, which, com- with the oxygen of the air, forms nitrous acid, is escapes in the form of ruddy fumes. The position of nitric acid by the metals, the evolu- nitric oxide, and the subsequent formation of acid, form a simple test for nitric acid. When pour of nitric acid is passed through a porcelain t a red heat, it is resolved into oxygen and n gases. Nitric acid, as it exists in the nitrates, drous, and is composed of Ox. $-5=40-$ Nit. 1 54.

hydrates of nitric acid are thus expressed, NO_5 nd NO_5. 4HO. No compound containing f water appears to exist.

urities.—The nitric acid of the shops is fre- y adulterated with hydrochloric and sulphuric In order to detect these, dilute the acid with or four parts of distilled water, then add to te portions of the diluted acid solutions of ni- of baryta and nitrate of silver. If sulphuric a sulphate be present, an insoluble white pre- e is thrown down, which is the sulphate of . In the new Pharmacopœia, the chloride of ı is recommended as a test. If hydrochloric e present, on adding nitrate of silver, a curdy precipitate is produced, the chloride of silver. at, nitric acid passes off in the form of vapour, it leaving any residue. About 217 grs. of crys- l carbonate of soda should be saturated by 100 this acid.

:.—This acid is employed in several pharma- al preparations; as, Argenti Nitras, Hydrargyri -Oxydum, Spiritus Ætheris Nitrici, and Un- ım Hydrargyri Nitratis.

DUM NITRICUM DILUTUM.—This is made by three fluid ounces of nitric acid with seven fluid *of distilled water.*

cinal Uses.—This acid is a powerful tonic,

efficacious in venereal ulcerations, and in restor
powers of the system when debilitated by a m
course; also in some cases in which the exhib
mercury is contraindicated, and where secondar
toms, especially ulceration of the throat, are m
rapid progress. Much diluted with water, it f
acidulous drink, which has been found beneficial
chronic hepatic affections which are dependei
long residence in a warm climate. Sir B. Bro
fers it as a lithontriptic in cases of the phospha
thesis. When diluted sufficiently, it forms an e
application to indolent ulcers. The dose of the
acid is from ɱx. to xl., in any proper vehicle.
neutralized by 154 grs. of crystallized carbo
soda.

ACIDUM PHOSPHORICUM DILUTUM (O_5 Phi. E
—*Ingredients.* — Phosphorus, Nitric Acid, D
Water.

Remarks.—In this process the nitric acid o
the phosphorus, and nitric oxide gas is evolved.
process should be conducted slowly, especially if
nitric acid is employed, as the action is sometim
violent, and the escape of nitrous gas is uncontr
rapid. But when diluted nitric acid is use
changes take place more gradually, and the
phorus, melting slowly, decomposes the nitri
absorbing a large proportion of its oxygen, and
free the remainder in the form of nitrous gas.
tion of the nitric acid distils over before the w
the phosphorus is acidified; hence the direction
portion of it should be returned into the retort.
evaporation should always be conducted in ves
platinum, as phosphoric acid acts chemically upo
of glass or porcelain, and thereby it is rendered i
During the oxidation of the phosphorus by nitri
water is decomposed; its oxygen uniting wi
phosphorus, and its hydrogen with the nitro
the nitric acid. Ammonia is thus formed,

however, is expelled by the heat applied in the last part of the process.

Properties.—Phosphoric acid is colourless, intensely sour to the taste, reddens litmus strongly, and neutralises alkalies; but it does not destroy the texture of the skin like sulphuric and nitric acids. It is soluble in water in all proportions, and heat is produced during its combination. Its solution may be evaporated at a temperature of 300° without producing decomposition. When the hydrate of the acid is heated for several days to 415°, it loses nearly two-thirds of an equivalent of water, and the residue consists chiefly of pyrophosphoric acid, with two equivalents of water. At a still higher temperature, metaphosphoric acid is formed.

Each equivalent of phosphoric acid requires three atoms of water to be present. The leading difference between the phosphoric, metaphosphoric, and pyrophosphoric acids, is, that the first is apt to combine with three equivalents of base, the second with two, and the third with one.

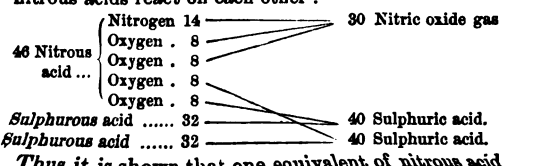
Impurities.—If any sulphuric acid or sulphate is present, chloride of barium will cause a white precipitate, which is insoluble in nitric acid. Hydrochloric acid, or any chloride in solution, may be detected by nitrate of silver producing a precipitate, which is insoluble in nitric acid. Its sp. gr. should be 1·064; 42 grains of carbonate of soda are saturated by 100 grains of this acid, and no precipitate should be thrown down on the addition of the soda, as this would prove the presence of some phosphate which is insoluble in water.

Medicinal Uses.—Phosphoric acid possesses tonic properties, but it is generally employed in cases of exostosis, and those cases where there is a tendency to the deposition of phosphate of lime in the system. Compresses, moistened with the diluted acid, have been applied with *advantage to* ulcers caused by *adjacent carious bone. Dose,* ♏xx. to f ʒj.

ACIDUM SULPHURICUM DILUTUM ($S O_3$ eq. 40 of Anhydrous Salt).—One and a half parts of strong acid are mixed with fourteen and a half of water. The acid should be added cautiously, and by degrees, to the water, otherwise, if the mixture be made in a glass vessel, the vessel may be broken by the sudden evolution of heat which attends the combination of the acid with the water.

Strong sulphuric acid is prepared in this country, and in most parts of the Continent, by burning eight or nine parts of sulphur with one of nitrate of potass in chambers lined with lead, the floor of which is covered, to the depth of several inches, with water. The sulphur is converted into sulphurous acid during its combustion, by combining with the oxygen of the air. The nitric acid of the nitrate of potass is also converted into nitrous acid and binoxide of nitrogen, which latter, by mixing with the air at the moment of its evolution, forms ruddy fumes of nitrous acid. There are, therefore, present in the leaden chamber nitrous and sulphurous acids, aqueous vapour, and atmospheric air. The sulphurous and nitrous acids combine with some aqueous vapour, forming a peculiar crystalline compound, which, falling into the water at the bottom of the chamber, is resolved into sulphuric acid, which remains in combination with the water, and nitric oxide gas, which is evolved.

The annexed diagram explains the nature of the changes which take place when the sulphurous and nitrous acids react on each other :—



Thus it is shown that one equivalent of nitrous acid

is sufficient to convert two atoms of sulphur*ous* acid into two of sulphur*ic* acid, with the disengagement of one proportion of nitric oxide gas. The nitric oxide gas thus formed being specifically light, ascends to the top of the chamber, and mixing with a fresh quantity of atmospheric air, becomes converted into nitrous acid, which descends, on account of its great specific gravity, and again meeting with sulphurous acid and aqueous vapour, a crystalline compound is formed, which falls into the water, and is converted, as before, into sulphuric acid and nitric oxide gas. Thus, the same combinations and decompositions continue to take place until the water at the bottom of the chamber becomes strongly acidulated, and of a proper specific gravity.

Properties.—Liquid sulphuric acid is transparent, colourless, and inodorous, and has a thick oily appearance. It possesses acid properties in a very high degree; for even when much diluted with water, it tastes extremely sour, and reddens the vegetable blues. In its undiluted state it is highly corrosive; it decomposes all animal and vegetable substances by the aid of heat, and the products are, charcoal, which is deposited, and water, which combines with the acid. It oxidizes the metals by the aid of heat, sulphurous acid gas being evolved. When diluted, it dissolves those metals which by its agency decompose water, such as iron or zinc, hydrogen gas being evolved. This acid, in its most concentrated form, has a sp. gr. of 1·847, or a little higher, but it never exceeds 1·850. When at this density, it boils at 620° F., according to Dalton, and it consists of one atom of real acid united to one of water. The sulphuric acid of commerce freezes at 15° F. By passing sulphuric acid in vapour through a porcelain tube, heated to redness, it is resolved into sulphurous acid and oxygen.

Impurities.—The sulphuric acid of commerce is *always contaminated with* small quantities of sulphates

of potassa and lead. It is effectually separated from these impurities by distillation, the acid passing over into the receiver, and the fixed salts remaining in the retort. It should be colourless, which proves that it does not contain any carbonaceous matter, or excess of sulphur, which would tend to give it a blue, green, or brown tint, according to the quantity present. When the acid is diluted, and hydrosulphuric acid passed through it, no colouring should be produced. This proves the absence of metallic impregnations. Berzelius found traces of titanium in English oil of vitriol, and of selenium in the Swedish. Arsenic is also sometimes found in it.

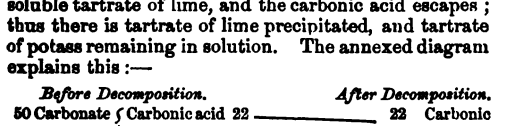
Pharmaceutical Uses.—It enters into the composition of the *Infusum Rosæ*, *Potassæ Sulphas* and *Bisulphas*, *Sodæ Sulphas*, *Ferri Sulphas*, and *Zinci Sulphas*. It is used in the preparation of *Acidum Citricum*, *Hydrochloricum*, *Nitricum*, and *Tartaricum*; *Æther Sulphuricus*; *Antimonii Oxysulphuretum*; *Hydrargyri Chloridum* and *Bichloridum*; *Potassæ Bicarbonas*, and *Sodæ Sesquicarbonas*.

Medicinal Uses.—Sulphuric acid not only possesses refrigerant and antiseptic properties, in common with the other mineral acids, but it also has astringent qualities, that render it a most useful medicine in hæmorrhage from the lungs, stomach, intestines, or uterus. It is also used to check the colliquative sweat in hectic fever. Owing to its antiseptic and refrigerant power, it is exhibited with benefit in low typhoid fevers, and other putrid diseases. It is often added to gargles which are used to relieve relaxation of the uvula, or to check salivation. The dose of the diluted acid is from ♏x. to ♏xl. f ℥j saturates 216gs. carb. sodæ.

ACIDUM TARTARICUM ($C_4 O_5 H_2$ Eq. 66.)—*Ingredients.*—Bitartrate of Potass, Boiling Distilled Water, *Prepared* Chalk, Dilute Sulphuric Acid, Hydrochloric *Acid.*

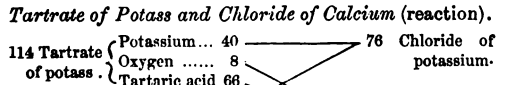
Remarks.—When chalk (carbonate of lime) is added

to the bitartrate of potass, the lime combines with the excess of tartaric acid in the bitartrate, forming an insoluble tartrate of lime, and the carbonic acid escapes; thus there is tartrate of lime precipitated, and tartrate of potass remaining in solution. The annexed diagram explains this:—



After the effervescence has ceased in this part of the process, the remaining portion of chalk, previously converted into chloride of calcium by being dissolved in hydrochloric acid, is to be added. A double decomposition now takes place between the neutral tartrate of potass which is in solution, and the newly added chloride of calcium; the changes that occur being, that the chlorine of the chloride of calcium unites with the potassium of the potass, forming a chloride of potassium which remains in solution; and the disengaged calcium unites with the oxygen which is separated from the potassium, forming lime, which, combining with the tartaric acid of the decomposed tartrate of potass, forms tartrate of lime, which is precipitated.

Tartrate of Potass and Chloride of Calcium (reaction).



Thus all *the tartaric acid* in the bitartrate originally *employed is combined with* lime instead of potass.

When the tartrate of lime thus formed is mixed with sulphuric acid, it is decomposed; the sulphuric acid combines with the lime, and forms a sulphate of lime, which is precipitated; the tartaric acid remains in solution, and may be obtained in crystals by evaporation and crystallization.

Properties.—Tartaric acid is colourless and inodorous, and its aqueous solution is very sour. Its crystals are large, and their primary form is that of an *oblique rhombic prism.* It is soluble in five parts of water at 60°. When exposed to a high temperature, it is decomposed: and by its destructive distillation, a peculiar acid, called pyrotartaric acid, is formed. When tartaric acid is added in excess to potass, it forms a salt which is but sparingly soluble: this is a remarkable characteristic of this acid. Tartaric acid dissolves and combines with many metallic oxides, with the alkalies, and many of the earths. It decomposes the carbonates with effervescence, and throws down potass from its undiluted solutions in the form of crystals of the bitartrate.

In the crystallized state it consists of Ac. Tart. 1 = 66 Aq. 1 = 9 = 75.

Impurities.—This acid sometimes contains sulphuric acid. This may be detected by adding chloride of barium, which gives a precipitate insoluble in an excess of hydrochloric acid. Hydrochloric acid may be detected by nitrate of silver, which throws down an insoluble chloride of silver. Acetate of lead should not throw down a precipitate which is insoluble in dilute nitric acid. This acid should be totally soluble in water.

Medicinal Uses.—This acid is employed as a substitute for citric acid, as it is much cheaper, and equally adapted for the preparation of effervescing *draughts.* It is used in the preparation of *sodaic* and *Seidlitz powders.*

CHLOROFORMYL, CHLOROFORM ($C_2 H Cl_3$ Eq. 121). —*Ingredients.*—Chlorinated Lime, Rectified Spirit, Water, and Chloride of Calcium. When 2 eqs. of alcohol are brought into contact with 8 eqs. of hypochlorite of lime, and these are diluted with water and exposed to heat, there are formed 1 eq. of chloral, 5 eqs. chloride of calcium, 2 eqs. of formiate of lime, 1 eq. of lime, and 9 eqs. of water; by the further mutual action of the 1 eq. of lime, the 1 eq. of water, and the 1 eq. of chloral, a rearrangement of these compounds takes place, forming 1 eq. of chloroform or terchloride of formyl, which distils, and 1 eq. of formiate of lime. This last with the two former eqs. of formiate of lime, is converted by the action of excess of lime and its hypochlorite into 6 eqs. of carbonate of lime, which combine with the chloride of calcium, forming a brilliant arenaceous powder—thus. (See diagram next page.)

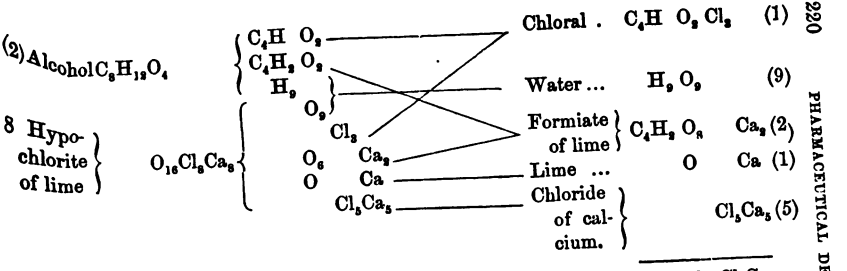
Properties.—Chloroform is a transparent colourless liquid, sp. gr. 1·48 to 1·5, very volatile, of a cool sweet taste, and agreeable ethereal smell.

Medicinal Uses.—As an anæsthetic agent in the performance of operations, &c. For inhalation from ℥j to ℥ij may be used. Dose internally from ♏v. to ♏xxx. dissolved in mucilage by the addition of rectified spirit. When adulterated, its use is highly objectionable.

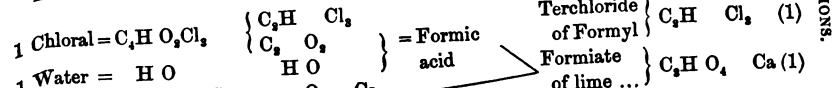
ÆTHER SULPHURICUS ($C_4 H_5 O$).—*Ingredients.*—Rectified Spirit, Sulphuric Acid, Carbonate of Potass, previously ignited.

Remarks.—The simplest account of the process of etherification is, that the acid abstracts water from the alcohol, and that ether is nothing more than alcohol deprived of one-half of its elementary water. This theory is explained by the annexed diagram.

Alcohol.		Ether.		Water.
4 Carbon		4 Carbon		
6 Hydrogen	=	5 Hydrogen	+	1 Hydrogen
2 Oxygen		1 Oxygen		1 Oxygen



The chloral, lime, and 1 eq. of water, are again decomposed.



Thus alcohol may be considered as composed of 2 eq. olefiant gas ($C H_2$) and 2 water; ether, of 2 olefiant gas and 1 water. If the distillation be pushed further with the acid, olefiant gas is given off pure. By this diagram it is shown, that if from two equivalents of alcohol one of water be withdrawn, the remaining elements are in the exact proportions for constituting ether.

According to Mr. Hennell, when equal weights of sulphuric acid and alcohol are put together without the application of any heat beyond that generated during the mixture, the most important and abundant product is *sulpho-vinic acid*, above one half of the sulphuric acid being converted into that acid by union with hydrocarbon; the sulphuric acid at the same time loses four-sevenths of its power of precipitating oxide of lead. This acid is composed of two atoms of sulphuric acid and one of alcohol.

When an equivalent of this acid is heated, it is decomposed; the two equivalents of sulphuric acid and one equivalent of water remain in the retort; and the other elements unite to form ether, which distils over.

Properties.—Sulphuric ether is transparent, colourless, and very volatile; has a fragrant odour, and a hot pungent taste. When in its purest form, its sp. gr. is about 0·700. Under the atmospheric pressure, ether of the density 0·720 boils at 96° or 98° F., and at about 40° below zero, *in vacuo*. At 46° below zero it is congealed. It combines with alcohol in every proportion, but water can only dissolve a small quantity of it. It is highly inflammable, and the products of its combustion are water and carbonic acid. From the rapidity with which its evaporation takes place, it occasions intense cold, sufficient, under favourable circumstances, for freezing mercury. It combines with ammonia, *camphor*, resins, volatile oils, and some *of the alkaloids, sulphur*, phosphorus, and chloride of

gold; but the fixed alkalies, their carbonates, metallic oxides, and earths, are insoluble in this menstruum.

Impurities.—Its sp. gr., which is a good test of its purity, should be 0·750. It should evaporate totally in the air. If it contain any sulphuric acid, a solution of baryta, or litmus, will detect it. If it contain any alcohol, phosphorus will be but imperfectly dissolved in it, and a milky fluid will be formed. When kept for some time without disturbance, it undergoes a spontaneous decomposition, and acetic acid, perhaps a little alcohol, and a particular oil, are produced. A fluid ounce of either is soluble in half a pint of water.

Medicinal Uses.—Ether is a powerful diffusible stimulant, but very transient in its effects: it resembles alcohol in its mode of acting, and, like it, is capable of producing intoxication. When applied externally, and allowed to evaporate, it is an excellent refrigerant, and is employed in diminishing the excessive circulation in the brain in fevers, and in facilitating the reduction of strangulated hernia. As an antispasmodic, it is administered in spasmodic asthma, in cramp in the stomach, singultus, and hysteria. As a stimulant, it is employed in low fevers of the typhoid type. *Dose,* f ʒss. to f ʒij.

Oleum Ætherum (C_{16} H_{17} O, 2 SO_3 = 201).—*Ingredients.*—Rectified Spirit, Sulphuric Acid, Solution of Potass, Distilled Water.

Remarks.—The products of this distillation are, ether, water, sulphurous acid, and a yellow oily fluid which floats upon the water. The theory of the formation of the ether and water has been already exemplified; the sulphurous acid is formed by the re-action of a portion of the alcohol on the sulphuric acid, and the black scum or froth is owing to a portion of the carbon of the decomposed alcohol being set free. When the yellow oily matter is exposed to the air, the ether with which it was mixed evaporates; and when the

sulphurous acid is removed by means of the potass, the residue is the *oleum æthereum*.

Properties.—It is thick and oily, of a yellowish colour, and less volatile than ether. Its sp. gr., according to Mr. Hennell, is 1·05, and according to Dumas, 1·133. It is insoluble in water, but soluble in alcohol and ether; it has a fragrant odour, and an aromatic, bitterish, and pungent flavour. It should be totally soluble in sulphuric ether, and not give evidence of acidity with litmus.

According to Serullas, ethereal oil is a *sulphate of ether*—sulph. ac. 1 = 40, ether 1 = 37 = 77.

Officinal Preparations.—Spiritus Ætheris Sulphurici Compositus.

Medicinal Uses.—As a medicine it is unimportant.

SPIRITUS ÆTHERIS NITRICI ($C_4 H_5 O NO_5 = 75$).—*Ingredients.*—Rectified Spirit, Nitric Acid.

Remarks.—When a mixture of nitric acid and alcohol is submitted to distillation, an exceedingly violent reaction is apt to take place, and nearly all the mixture is converted into gas and vapour; protoxide and binoxide of nitrogen, together with carbonic acid and free nitrogen, are evolved; and by the mutual decomposition of the acid and alcohol, ether is formed; the distillation of which should be conducted at a gentle heat, as it is decomposed, when distilled quickly, at a higher temperature, and resolved into alcohol, nitrous acid, and a little acetic acid.

Properties.—In its leading properties, the nitrous agrees with the sulphuric ether, but it is more volatile. It dissolves readily in alcohol, but is sparingly soluble in water. According to Dumas and Boullay, it consists of olefiant gas $4 \times 7 = 28$, aq. $1 = 9$, hyponitrous acid $1 = 38 = 75$

The *spiritus ætheris nitrici* of the Pharmacopœia is a solution of nitrous ether in alcohol. It is colourless, and has a *fragrant ethereal* odour; its taste, when *recently prepared, is pungent* and slightly sweet, but

when kept a few weeks it acquires a manifest acidity. If the distillation be carried too far, the product is heavier, high-coloured, of a much less agreeable odour, and very acid. Its sp. gr. should be 0·834. It is soluble in alcohol and in water. On the addition of carbonate of soda to this preparation, no bubbles should be evolved.

Medicinal Uses.—It is refrigerant, diaphoretic, antispasmodic, and diuretic. It is employed as a grateful refrigerant in inflammatory affections, and as a diuretic in dropsies. In these cases, however, it is employed only as an auxiliary to other diuretics. Combined with balsam of copaiba, it is frequently employed in gonorrhœa. *Dose*, from ♏xx. to ♏xl.

ACONITINA (C_{60} H_{47} NO_{14}=533). — *Ingredients.* —Root of Aconite, dried and bruised, two pounds; Rectified Spirit, Diluted Sulphuric Acid, Solution of Ammonia, Purified Animal Carbon, of each as much as may be sufficient.

Remarks.—By boiling the aconite root in spirits, the *aconitina*, with its peculiar acid, is dissolved; and by distillation and evaporation this solution is reduced to the consistence of an extract. To the thick solution of this extract in water, dilute sulphuric acid is to be added, which, combining with the aconitina, forms a sulphate of that alkaloid. On the addition of the solution of ammonia, a sulphate of ammonia is formed, which remains in solution, and the aconitina is precipitated. On again forming a sulphate of aconitina, and precipitating with ammonia, aconitina is obtained in a pure state. The animal charcoal is used to remove any vegetable colouring matter which may adhere to the active principle.

Properties.—A portion of this alkali crystallizes in granular crystals, but the greater part of it is not capable of crystallizing. It is soluble in water, alcohol, and

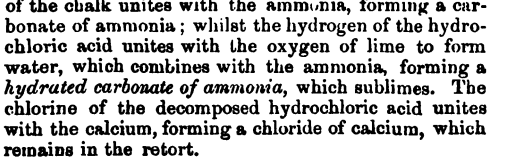
ether, and its solutions are decidedly alkaline. It is composed, like other active vegetable principles, of carbon, oxygen, hydrogen, and nitrogen. The nature of the acid with which this substance is combined in the plant has not yet been determined.

Medicinal Uses.—This substance is a powerful narcotic and anodyne. It is, however, too dangerous a medicine to be exhibited internally. It has been employed in the form of an ointment in neuralgic affections. The proportions generally used are, one grain of aconitina to one drachm of the lard.

Should it be administered internally, the first dose ought not to exceed the one-twentieth of a grain.

AMMONIÆ SESQUICARBONAS ($2\ NH_3, 3\ CO_2, 2\ HO = 118$).—*Ingredients.*—Hydrochlorate of Ammonia, Chalk.

Remarks.—When hydrochlorate of ammonia and chalk are mixed, and heat is applied, the carbonic acid of the chalk unites with the ammonia, forming a carbonate of ammonia; whilst the hydrogen of the hydrochloric acid unites with the oxygen of lime to form water, which combines with the ammonia, forming a *hydrated carbonate of ammonia*, which sublimes. The chlorine of the decomposed hydrochloric acid unites with the calcium, forming a chloride of calcium, which remains in the retort.



Owing to a portion of the ammonia being dispelled by the *heat employed, and yielding* its carbonic acid to

another portion, which remains undecomposed, converting it into bicarbonate, this salt is properly termed *hydrated sesquicarbonate of ammonia.*

Properties.—When recently prepared, this salt has a crystalline texture, and a pungent odour. It is soluble in four parts of cold water. It has alkaline properties, and changes the vegetable colours to a green. When heated on a platinum spoon, it should leave no residue. It effloresces on exposure to the air, and becomes a bicarbonate, in consequence of the escape of a portion of the ammonia, and it is then inodorous. On saturating this salt with nitric acid, and then adding nitrate of silver, or chloride of barium, no precipitate should be thrown down. The non-action of nitrate of silver proves the absence of hydrochloric acid, and the chloride of barium, producing no precipitation, proves the absence of sulphuric acid.

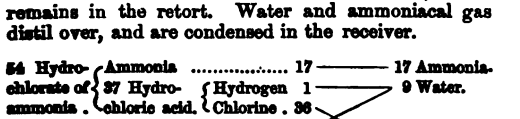
Officinal Preparations.—Liquor Ammoniæ Sesquicarbonatis, Liquor Ammoniæ Acetatis, Cupri Ammonio-Sulphas.

Medicinal Uses.—It is stimulant, antispasmodic, diaphoretic, strongly antacid, and in doses of half a drachm it is emetic. As a stimulant, it is used in typhoid fevers, and in gout; as an antispasmodic, in hysterical affections; an antacid in dyspepsia; and as an emetic, in paralysis. Applied externally to the nostrils, it is a powerful stimulant in cases of syncope, poisoning by hydrocyanic acid, and hysteria. Its dose is five grains; as an emetic, 20 grains.

Liquor Ammoniæ ($NH_3 = 17$).—*Ingredients.*—Hydrochlorate of Ammonia, Lime, Water.

Remarks.—When the hydrochlorate of ammonia is mixed with lime and water, and submitted to distillation, the following changes take place:—The hydrochloric acid unites with the lime, and sets the *ammonia free;* a re-action at the same time takes *place between the* hydrochloric acid and the lime; the *oxygen of the* latter combines with the hydrogen of

the hydrochloric acid, forming water; and the chlorine and calcium unite to form chloride of calcium, which remains in the retort. Water and ammoniacal gas distil over, and are condensed in the receiver.



The distillation is directed to be stopped when fifteen fluid ounces have passed over, because when that quantity has been obtained, if the process be continued, the product becomes weaker, and at last nearly pure water passes over.

Properties.—Ammoniacal gas is colourless and transparent, and is remarkable for its pungent odour. It does not support combustion or respiration, but it inflames when mixed with oxygen gas and fired by a taper, water being formed and nitrogen set free. It has alkaline properties, turning the vegetable blues green; all its salts are volatilized or decomposed by heat. Water can absorb 780 times its volume of this gas at ordinary temperatures, and alcohol is capable of condensing a large quantity of it. When a succession of electric sparks is passed through it, it is resolved into its elements; and the same effect is produced when it is passed through a red-hot porcelain tube. It is gaseous at ordinary temperatures, but becomes liquid when subjected to a pressure of six and a half atmospheres. One hundred cubic inches of this gas weigh 18 grains. It is composed of three volumes of hydrogen gas and one of nitrogen, condensed into two volumes; or by atom—$H_3=3$; $N_1=14=17$.

A combination of *two* equivalents of hydrogen with one of nitrogen, *constitutes* the body termed Amidogen, *whose existence is well* established by modern chemists,

although it has never been procured in a separate form. Its compounds are called *Amides.*

A combination of one of nitrogen with four of hydrogen, constitutes another body, which also has never been procured separate, termed *Ammonium,* which has all the properties of a metal. If one equivalent of oxygen be added to one of ammonium, the result is, one eq. of water and one of ammonia, $NH_4+O=NH_3+HO$.

Hence the terms *chloride* of *ammonium* and *hydrochlorate* of *ammonia* represent the same substance; just as *chloride* of *sodium* and *hydrochlorate* of *soda.*

On the application of heat to liquor ammonia, ammoniacal gas is driven off, and pure water remains. Lime water not producing a precipitate proves the absence of carbonic acid. When saturated with nitric acid, it should not yield a precipitate on the addition of sesquicarbonate of ammonia or nitrate of silver; and this proves that no earthy matter, hydrochloric acid, or chloride, is present.

Officinal Preparations.—Linimentum Ammoniæ, Spiritus Ammoniæ Succinatus, Linimentum Camphoræ Compositum, Linimentum Hydrargyri.

Medicinal Uses.—It is stimulant, rubefacient, and antacid: it may be exhibited in milk, or any liquid vehicle that is not incompatible with it. Applied to the nostrils it forms a powerful stimulant, and is used in syncope and poisoning by hydrocyanic acid. When employed as a rubefacient, it is generally mixed with oil, or with soap liniment. *Dose,* from ℥x. to ℥xxx.

LIQUOR AMMONIÆ ACETATIS ($N H_3, C_4, H_3 O_3 = 68$).—*Ingredients.*—Sesquicarbonate of Ammonia, Distilled Vinegar.

Remarks.—The acetic acid combines with the ammonia, forming an acetate of ammonia, which remains *in solution,* whilst the carbonic acid is repelled with *effervescence.* The quantity of the ammoniacal salt requisite for saturation will depend on the state of this

substance. If it has become opaque, and necessarily partly converted into bicarbonate, more will be required than if the salt is a true sesquicarbonate. It is preferable that there should be a slight excess of acid in this preparation, as it is sometimes used as an external application in cases in which the acrimony of an alkali would be injurious.

Properties.—Solution of acetate of ammonia should be transparent and colourless. When a portion of it is heated on a capsule of glass or platinum, it should evaporate without leaving a residue.

Impurities.—When the vinegar contains any metallic impregnation, hydrosulphuric acid causes a change of colour in this preparation. The absence of sulphuric and hydrochloric acid is proved by no precipitate being thrown down on the addition of nitrate of silver or chloride of barium.

Medicinal Uses.—When assisted by warmth, this is a good diaphoretic. When the surface of the body is kept cool, it acts as a diuretic. It is occasionally used as a collyrium. *Dose*, from f℥ss. to f℥i.

LIQUOR AMMONIÆ CITRATIS ($3\ N\ H_3$, C_{12}, H_5, O_{11} = 216).—*Ingredients.*—Citric Acid, Distilled Water, and Sesquicarbonate of Ammonia.

The observations applied to the preceding are equally applicable to this, citric being substituted for acetic acid.

Medicinal Uses.—Diaphoretic and febrifuge. *Dose*, ℥iij. ℥i.

MORPHIA* (C_{35}, H_{20}, $N\ O_6$ = 292).—*Ingredients.* Hydrochlorate of Morphia, Solution of Ammonia, Distilled Water.

Remarks.—This is a case of single elective affinity, in which the ammonia combines with the hydrochloric acid, forming a hydrochlorate of ammonia, which remains in solution, and the disengaged morphia is precipitated.

* *Omitted* in present Pharmacopœia.

Properties.—Morphia was discovered in *opium* in 1816, by Sertuerner. It requires 1000 parts of cold and about 400 of boiling water to dissolve it. Its solution restores the colour of turnsole reddened by an acid, and changes the yellow of turmeric to a brown. It is soluble in forty times its weight of pure alcohol when cold, and in thirty times its weight of boiling alcohol. It is soluble also in the fixed and volatile oils, in solution of potash and soda, and to a small degree in ammonia. It is insoluble in ether. Concentrated nitric acid gives with it, as well as its salts, a fine red colour, which afterwards becomes yellow. The neutral salts of iron give a blue colour to it and its salts, which disappears by the action of heat, or of alcohol, acetic ether, or an acid, and is revived on the addition of an alkali. The red colour produced by the action of nitric acid on morphia closely resembles the colour caused by the same acid with brucia: on adding protochloride of tin, however, to the acid solution of brucia, a violet colour is produced, whilst the acid solution of morphia is not affected.

Medicinal Uses.—Pure morphia is not used medicinally, being nearly insoluble. It is always given in combination with an acid.

MORPHIÆ ACETAS (C_{25} H_{20} N O_6 C_4 H_3 O_3, H O = 352.—*Ingredients.*—Morphia, Acetic Acid, Distilled Water.

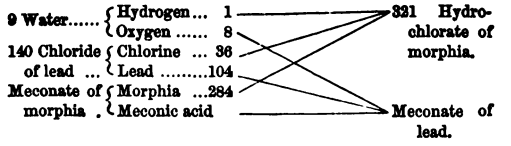
Remarks.—The acetic acid combines with the morphia, forming an acetate of morphia, which on evaporation is obtained in nearly colourless radiating needle-like crystals. The salt is composed of one atom of the base, combined with an equivalent of acid. It should be very soluble in water.

Medicinal Uses.—Vide MATERIA MEDICA, Art. OPIUM.

MORPHIÆ HYDROCHLORAS. (Morphia 1 = 292 *Hydrochloric Acid* 1 = 37. Aq. 6 × 9 = 54 = 383).—*Ingredients.*—Opium, Crystals of Chloride of Lead,

Purified Animal Charcoal, Hydrochloric Acid, Distilled Water, Solution of Ammonia.

Remarks.—Morphia exists in opium in combination with meconic acid, and the first part of the process here directed is to obtain an aqueous solution of the meconate of morphia from the opium. On the addition of a solution of chloride of lead to the solution of meconate of morphia, a portion of water becomes decomposed; its hydrogen unites with the chlorine of the chloride of lead, forming hydrochloric acid, which combines with the morphia, forming hydrochlorate of morphia, which remains in solution; its oxygen unites with the lead, forming an oxide of lead, which combines with the meconic acid, forming a meconate of lead, which is precipitated.


9 Water..... Hydrogen... 1
Oxygen 8
140 Chloride of lead ... Chlorine ... 36
Lead 104
Meconate of morphia . Morphia ...284
Meconic acid
321 Hydrochlorate of morphia.
Meconate of lead.

When the solution of hydrochlorate of morphia, thus obtained, is treated with solution of ammonia, the hydrochloric acid unites with ammonia, forming a hydrochlorate of ammonia, which remains in solution, and morphia is precipitated. When the morphia thus precipitated is washed with distilled water, and then saturated with hydrochloric acid, crystals of hydrochlorate of morphia are obtained on evaporation. Animal charcoal is used to remove any colouring matter, in order that the crystals may be obtained colourless.

Properties.—Hydrochlorate of morphia is a colourless, inodorous, and bitter salt; its crystals are *acicular; it is soluble* in alcohol; and from sixteen to

twenty times its weight of water. It should be completely volatilized by exposure to a red heat.

Medicinal Uses.—Vide MATERIA MEDICA, Art. OPIUM.

QUINÆ DISULPHAS ($2C_{20}H_{12}NO_2SO_3 8HO = 436$). —*Ingredients.*—Heart-leaved Cinchona, Sulphuric Acid, Purified Animal Charcoal, Hydrated Oxide of Lead, Solution of Ammonia, Distilled Water.

Remarks.—By boiling the *Cinchona cordifolia* in distilled water, acidulated with sulphuric acid, the active principle of the bark is dissolved. The solution thus obtained contains *cinchonic* and sulphuric acids, quina, and colouring matter. When the oxide of lead is added, the sulphuric acid unites with it, forming a sulphate of lead, which is precipitated, and the cinchonate of quina remains in solution. On removing the precipitate of sulphate of lead, and adding ammonia, the cinchonic acid combines with the ammonia, forming cinchonate of ammonia, which remains in solution, and the quina is precipitated. On adding dilute sulphuric acid to the quina, a disulphate of quina is procured, which, being purified by digestion with charcoal, is obtained in crystals on evaporation.

Properties.—The crystals are colourless, acicular, have a bitter taste, and are efflorescent when exposed to the air. One part of this salt is soluble in about 740 parts of cold and 30 of boiling water.

Impurities.—This salt has been adulterated with boracic acid, sulphates of lime and magnesia, sugar, mannite, stearine, and starch. If boracic acid be present, an alcoholic solution of the sulphate will burn with a green flame. Earthy salts, as the sulphates of lime or magnesia, are detected by their not being driven off at a red heat, the vegeto-sulphate being completely dissipated. Iodine will detect the presence of *starch.* Sugar or mannite may be detected by adding *ammonia, which* precipitates the quina, and on evaporation the liquor should not taste of sugar. Stearine

may be detected by dissolving the disulphate in water acidulated with sulphuric acid; the stearine, if present, will remain undissolved. Salicin is detected by sulphuric acid.

Medicinal Uses.—Vide MATERIA MEDICA, Art. CINCHONA.

STRYCHNIA (C_{44} H_{24} N_2 O_4 = 348).—*Ingredients.*—Nux Vomica, bruised, Rectified Spirit, Diluted Sulphuric Acid, Magnesia, Solution of Ammonia.

Remarks. — The *strychnos* nux vomica contains strychnate of strychnia, strychnate of brucia, colouring matter, gum, bassorin, starch, wax, fixed oil, and lignin. The acid here called *strychnic* was formerly known as *igasuric acid.*

When to the distilled alcoholic solution of strychnate of strychnia, magnesia is added, a strychnate of magnesia is formed, which is precipitated with the strychnia. On digesting the precipitate thus obtained in alcohol, the strychnia is dissolved, and the strychnate of magnesia remains; when this alcohol is distilled, strychnia remains, and this is to be treated with dilute sulphuric acid, which converts it into sulphate of strychnia. On dissolving the sulphate of strychnia in distilled water, and adding a solution of ammonia, the sulphuric acid combines with the ammonia, forming a sulphate of ammonia, which remains in solution, and the strychnia is precipitated. The strychnia is to be again dissolved in boiling alcohol, which deposits it on cooling.

Properties.—Strychnia is colourless and inodorous; its taste is extremely bitter, leaving a metallic impression in the mouth. It is not altered by exposure to the air; 100,000 parts of cold water dissolve only 15 parts of strychnia; but it dissolves in 2500 times its weight of boiling water. It is insoluble in absolute alcohol; it is, however, soluble in diluted alcohol.

Medicinal Uses.—*Strychnia* is a powerful excitant *of the motor tract of the* medulla spinalis. It has

been strongly commended in cases of paralysis, especially those forms unattended with decided organic lesion. It has also been given in nervous affections. *Dose*, gr. $\frac{1}{16}$ to gr. $\frac{1}{2}$. Strychnia is a powerful poison, and has been recently the subject of much controversy in a remarkable trial, as to its effects and properties, without a satisfactory result.

VERATRIA (C_{32} H_{24} NO_6 = 266 — Pelleter and Dumas ; C_{68} H_{43} N_2 O_{12} = 575—Couerbe)—*Ingredients.*—Sabadilla Seeds, bruised, Rectified Spirit, Diluted Sulphuric Acid, Solution of Ammonia, Purified Animal Charcoal, Magnesia.

Remarks.—The *Helonias officinalis* (Sabadilla) contains veratria in combination with gallic acid. By boiling in the spirit, a solution of gallate of veratria is obtained ; on distilling the spirit, and treating the residue with dilute sulphuric acid, a sulphate of veratria is formed : this is decomposed by the magnesia, a sulphate of magnesia being the result, and the veratria is precipitated. Spirit is now added, which takes up the veratria ; and on the former being distilled over, the residue (veratria) is to be boiled in distilled water, acidulated with sulphuric acid, and having animal charcoal mixed with it ; a sulphate of veratria is thus formed, which, being decolorized by the charcoal, is separated from it by straining the solution. The last part of the process consists in evaporating until the solution is the consistence of syrup, and then adding solution of ammonia ; a sulphate of ammonia remains in solution, and the veratria is precipitated. This is to be washed and dried.

Properties.—Veratria is white, pulverulent, has no odour, but produces violent sneezing. In very small doses, it produces violent vomiting with hypercatharsis ; and experiments have proved that a few grains may *produce death.* It is but very slightly soluble in cold *water ; boiling* water dissolves about 1-1000th part ; *it is very soluble* in alcohol, and is but sparingly soluble

in ether. It fuses at 124° F., and then it appears, on cooling, like yellow wax. It has the reaction of an alkali on litmus paper; its salts are not, however, crystallizable on evaporation, with the exception of the super or bisulphate.

Medicinal Use.—Doubtful. *Dose*, gr. $\frac{1}{15}$.

CARBO ANIMALIS PURIFICATUS. — *Ingredients.*—Animal Charcoal, Hydrochloric Acid, Water.

Remarks.—As animal charcoal is prepared from bones, it necessarily contains a quantity of the phosphates and carbonates of lime; and the use of hydrochloric acid in this process is to remove these impregnations.

Pharmaceutical Uses.—Animal charcoal reduced to a fine powder, is a powerful agent in decolorizing fluids, &c., and as such, is directed to be employed in several pharmaceutical processes. It loses the property of absorbing colouring matters by use, but recovers it by being heated to redness.

CORNU USTUM (8 Ca O, 3 PO_5 = 440).—*Remarks.*—When pieces of horn are burnt as here directed, the gelatine is resolved into its elements, which are evolved, and the residue is nearly pure phosphate of lime.

Properties.—Phosphate of lime is dissolved by most acids without decomposition and is thrown down from such solutions by ammonia or potass. It is very difficult to fuse, but in a glass-house furnace it softens, and acquires the semitransparency of porcelain. It is used for polishing gems and metals; for absorbing grease from cloth, linen, or paper; and for preparing phosphorus.

Medicinal Uses. — This medicine has been commended in rachitis and mollities ossium.

ALUMEN EXSICCATUM (Al_2 O_3 3 S O_3 K O, S O_3, 24 H O = 476).—*Remarks.*—By the heat applied, the alum is deprived of its water of crystallization; the heat must be *continued until* it ceases to boil and has *become quite solid.* When thus obtained, it is in the

form of a light, friable, spongy mass. If too high a heat be applied, part of the sulphuric acid of the alum will be driven off, which should be avoided. In this process the alum loses 45 per cent. of water.

Alum is a triple salt, being a super-sulphate of alumina and potassa. It is prepared from alum ores, which are chiefly composed of clay, alumina impregnated with sulphur, or sulphuret of iron. The ore, after calcination, is exposed to the atmospheric air; the sulphur attracts oxygen, forming sulphuric acid, which, uniting with the argillaceous earth of the clay, and with a portion of the potassa which the ore often contains, forms the salt commonly called *alum*. Alum occurs native, in an efflorescent form, in the interstices of the alum slate.

Properties.—This salt crystallizes in octahedra, is transparent, colourless, and of a vitreous appearance; it has a styptic taste, with a slight degree of sweetness; it reddens the vegetable blues; it is soluble in 16 parts of water at 60° F., and in three-fourths of its weight at 212°. The alkalies, alkaline carbonates, and alkaline earths, decompose it, precipitating alumina.

Alumina is an oxide of the metal *aluminum*, which may be obtained by the action of potassium on the chloride of aluminum: or by the action of potassium on alumina, the potassium abstracting the oxygen from the alumina.

Officinal Preparations. — Alumen Exsiccatum, Liquor Aluminis Compositus.

Medicinal Uses.—Alum is a powerful astringent, given internally in hæmorrhages and serous evacuations. It is administered in diabetes, in menorrhagia, and in leucorrhœa, in which disease it has been found the most successful astringent. It has been given in painter's colic, in doses of 20 grains. Its ordinary dose is five to ten grains. The best mode of administering alum is the form of "alum whey," *serum aluminosum*, which may be prepared by adding two drachms of pounded alum

to a pint of hot milk; the dose is three or four ounces.

It forms very styptic lotions, and is employed to check hæmorrhage by direct application. Dried alum applied externally, is a mild escharotic.

LIQUOR ALUMINIS COMPOSITUS.—*Remarks.*—This solution, variously diluted, is used to check hæmorrhage or profuse mucous discharges—as a collyrium and a lotion for old ulcers.

ANTIMONII OXYSULPHURETUM.—*Ingredients.*—Tersulphuret of Antimony, Solution of Soda, Distilled Water, Dilute Sulphuric Acid.

Remarks.—When an alkaline solution (in this case a solution of oxide of sodium), acts upon tersulphuret of antimony, a portion of the oxygen of the oxide of sodium uniting with a portion of the antimony of the tersulphuret, whilst the sodium combines with the sulphur of the sulphuret thus set free and forms a sulphuret of sodium. This last dissolves, another portion of sulphuret of antimony forming with it a soluble double sulphuret of antimony and sodium, whilst the oxide of antimony combines with a portion of the undecomposed soda, and this compound dissolves together with the double sulphuret. This solution, on the addition of sulphuric acid, is again decomposed, the soda unites with the acid and precipitates oxide of antimony, whilst the double sulphuret is converted into sulphate of soda and hydrated sulphuret of antimony; so that the precipitate consists of a mixture of oxide and sulphuret of antimony and of water.

Properties.—The oxysulphuret of antimony is of a bright orange colour, inodorous and has a slightly styptic taste. It is not readily acted upon by dilute acids, and is insoluble in water. It is composed of teroxide of antimony $1=153$; tersulphuret of antimony $5=885$; Aq. $15=135=1173$.

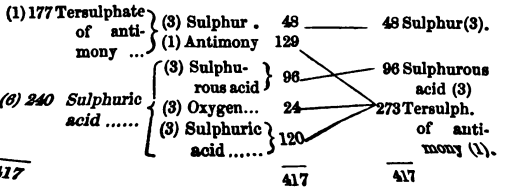
The oxy*sulphuret of* antimony should be totally *soluble in nitro-hydrochloric* acid.

Official Preparation.—Pilulæ Hydrargyri Chloridi Compositæ.

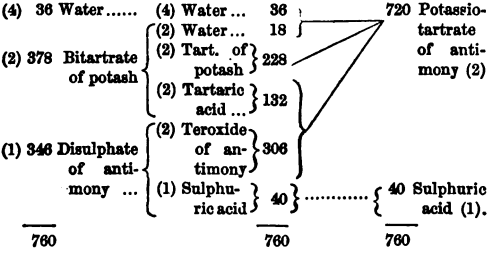
Medicinal Uses.—Diaphoretic, emetic, or cathartic, according to the dose; it is, however, less certain in its operation than the other preparations of antimony, and is very seldom employed except in combination with mercury in cutaneous diseases.

ANTIMONII POTASSIO-TARTRAS (SbO_3 C_4 H_2 O_5 KO C_4 H_2 O_5 3HO = 360).—*Ingredients.*—Tersulphuret of Antimony, Bitartrate of Potash, Sulphuric Acid, Distilled Water.

The changes which occur are these, 1 eq. of tersulphuret of antimony 177, is composed of 1 eq. of antimony 129, and 3 eqs. of sulphur 48. As the water of the sulphuric acid is merely evaporated, and plays no part in the decomposition, it may be considered as anhydrous—3 eqs. of which 120 may be considered as composed of 3 eqs. of oxygen 24, and 3 eqs. of sulphurous acid 96. When the sulphuret and acid act on each other, they are mutually decomposed, the 1 eq. of antimony 129 combines with the 3 eqs. of oxygen 24, to form 1 eq. of teroxide of antimony 153, and the 3 eqs. of sulphur 48 set free, subsequently ignite and escape as sulphurous acid gas; whilst the 3 eqs. of sulphurous acid 96, eliminated from the sulphuric acid, are driven off in dense suffocating fumes. The 1 eq. of teroxide of antimony 153, combines with three other and undecomposed eqs. of sulphuric acid 120, to form 1 eq. of tersulphate of antimony 273, the whitish brown pulverulent mass of the process.



These 273 of tersulphate on the addition of water are converted into a small portion of soluble supersulphate and an insoluble subsulphate, which latter by continual washing is converted into an anhydrous disulphate. When 1 eq. of dry disulphate of antimony 346, composed of 2 eqs. of teroxide of antimony 306, and 1 eq. of sulphuric acid 40, is boiled with 2 eqs. of bitartrate of potash 378, consisting of 2 eqs. of tartrate of potash 228, 2 eqs. of tartaric acid 132, and 2 of water 18, the 2 eqs. of teroxide of antimony 306, and form 2 eqs. of tartrate of antimony 438, which uniting with the 2 eqs. of tartrate of potash 228 and 6 eqs. of water 54, form 2 eqs. 720 of crystallized potassio-tartrate of antimony, the 1 eq. of sulphuric acid 40 remaining in the mother liquor.



Properties.—Tartarized antimony crystallizes readily, the primary form of the crystals being that of a octahedron, with a rhombic base. Their colour is white, and their taste slightly styptic and metallic. On being exposed to the air, the crystals effloresce slightly, and become opaque. Tartarized antimony is soluble in twice its weight of boiling water, and in fifteen times at 60° F. Its *solution, when the salt is pure, is quite transparent, but when kept,* for some time, it undergoes

spontaneous decomposition ; which, however, may be prevented, by adding to it a portion of spirit.

According to Dr. Thompson, this salt contains only two atoms of water.

Impurities.—Should the bitartrate of potash employed in the preparation of this salt contain any admixture of tartrate of lime, a precipitate of this substance is immediately thrown down, on dissolving the tartarized antimony in water. On the addition of the usual reagents for sulphuric and hydrochloric acids, there should be no precipitation. Hydrosulphuric acid should cause a reddish-coloured precipitate.

Officinal Preparation.—Vinum Antimonii Potassio-Tartratis.

Medicinal Uses.—Tartarized antimony acts, according to the dose, as a diaphoretic, an expectorant, an emetic, or a cathartic. It also exerts a powerful sedative influence. Its diaphoretic dose is one-fourth of a grain. The best mode of administering it as an emetic is, to dissolve from one to four grains in four ounces of water, and to administer one ounce of this solution every ten minutes until it causes vomiting. Made into an ointment with lard, it is used as an external application : in which case it acts as a powerful counter-irritant, and produces a pustular eruption.

VINUM ANTIMONII POTASSIO-TARTRATIS. — *Ingredients.*—Potassio-tartrate of Antimony, Sherry Wine.

Remarks.—Each fluid ounce of this solution contains two grains of the salt. *Dose*, ℥xv. to ʒi.

PULVIS ANTIMONII COMPOSITUS.—*Ingredients.*—Tersulphuret of Antimony, Horns shaved.

Remarks.—Sulphuret of antimony is composed of sulphur and antimony ; horn shavings, of phosphate of lime, and animal matter. When the sulphuret and horn-shavings are heated together, the sulphur of the sulphuret is driven off, and the antimony, combining with the oxygen of the air, forms antimonious acid. Part of the animal matter is dissipated by the heat,

but the phosphate of lime remains unchanged; the residuum, therefore, in the crucible, *is antimonious acid and phosphate of lime*, which forms the compound powder of antimony.

Properties.—It is intended as a substitute for the celebrated empirical remedy called "James's Powder," 100 parts of which Dr. Pearson found to consist of 57 parts of peroxide of antimony (antimonious acid), and 43 parts of phosphate of lime. Antimonial powder is of a dull white colour; it is insipid, inodorous, and insoluble in water. Owing to the different states of oxidation in which the antimony exists in this powder, it is a very uncertain remedy. This powder is partly soluble in hydrochloric acid, and its activity as a medicine will be in proportion to the turbidness caused by dropping the hydrochloric solution into water.

Medicinal Uses.—Some people continue to have faith in this powder; but it is good for nothing and inert. It is given for colds, fevers, &c.; but the good effects are derived from the antiphlogistic discipline enforced at the same time. *Dose*, from gr. iii. *ad libitum.*

ARGENTI CYANIDUM.—*Ingredients.*—Nitrate of Silver, Dilute Hydrocyanic Acid, Water.

Remarks.—When the solution of nitrate of silver is mixed with dilute hydrocyanic acid, as is here directed, the cyanogen of the hydrocyanic acid unites with the silver, forming a cyanide of silver, which is precipitated; the hydrogen of the acid combines with the oxygen of the oxide of silver, forming water, which remains in solution with the nitric acid.

Properties.—Cyanide of silver presents a whitish appearance; it is insoluble in water, but is soluble in hot nitric and sulphuric acids. It is also soluble in ammonia. When dried, and submitted to a red heat, cyanogen gas is evolved. It is composed of 1 equivalent of cyanogen = *26*; *1 equivalent* of silver = 108; equivalent = *134.*

Medicinal Uses.—It is employed for the extemporaneous preparation of hydrocyanic acid.

ARGENTI NITRAS ($AgO, NO_5 = 170$).—*Ingredients.*—Silver, Nitric Acid, Distilled Water.

Remarks.—In this process, the silver decomposes a portion of the nitric acid; the oxygen of the decomposed acid unites with the silver, forming oxide of silver, and this, combining with the undecomposed nitric acid, forms nitrate of silver; during the process, nitric oxide gas is evolved.

Properties.—The solution of nitrate of silver obtained by this process yields transparent crystals, the primary form of which is a *right rhombic prism.* This salt is soluble in its own weight of water at 60°, and in about four times its weight of alcohol. Its colour is changed by light, owing to the reduction of part of the oxide to the metallic state. When exposed to a strong heat, the nitric acid of the salt is decomposed, the oxygen is expelled, and the silver appears in its disengaged metallic state. The crystals are anhydrous.

Exposed to heat, the nitrate of silver fuses, and being poured in this state into cylindrical moulds, it forms "lunar caustic," which is generally of a dark colour; the best is, however, of a greyish white.

Impurities.—If nitrate of silver contains any copper, it may be detected by adding to its aqueous solution ammonia in excess: if a blue colour be produced, it is owing to the presence of oxide of copper. The precipitate thrown down by chloride of sodium from nitrate of silver should be perfectly soluble in an excess of ammonia.

Officinal Preparations.—Liquor Argenti Nitratis, Argenti Cyanidum.

Medicinal Uses.—Tonic, antispasmodic, astringent, and escharotic. It has been employed in the cure of epilepsy, chorea, and angina pectoris. A peculiar *disagreeable* effect is produced by the internal use of *nitrate of silver*—viz., the darkening of the skin, *especially in the parts* exposed to the light, which assume

a leaden hue; reduced silver of the *Daguerreotype* colour being deposited in the skin. Fused nitrate of silver is a powerful and most manageable caustic, since it is decomposed by contact with the animal tissues, and so destroys a mere superficial film. *Dose*, one eighth of a grain to one grain.

LIQUOR POTASSÆ ARSENITIS.—*Ingredients.*—Arsenious Acid, Carbonate of Potash, Compound Tincture of Lavender, Distilled Water.

Remarks.—During the boiling, the arsenious acid combines with the potash, forming *anarsenite of potash*, and the carbonic acid is evolved. Arsenious acid is not very soluble in water, but is rendered more easy of solution by being combined with potassa; hence it is used in this preparation. The tincture of lavender is merely used to give it colour and flavour, and to prevent its being mistaken for water. This is generally termed "Fowler's Solution of Arsenic."

Arsenious acid, the "White Arsenic," of commerce, is met with in the form of shining semivitreous masses, which break with a conchoidal fracture, and present the appearance of a yellowish glass. It has hardly any, or at least a faint sweetish taste. When subjected to a heat of 380° F., it sublimes, and condenses in the form of a crystalline powder; and if the sublimation be conducted slowly, and on a small quantity, proportionate to the size of the tube, the crystals will be found to consist of adamantine octahedra.

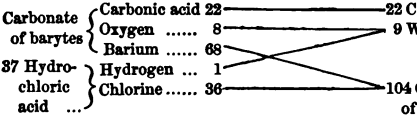
It is soluble in water, and Klaproth has shown that it requires for its solution 400 parts of water at 60°, and 13 parts at 212°. The solution of arsenious acid in boiling water yields minute crystals on cooling, which, when their form is defined, are octahedra. For the symptoms of poisoning, test, &c., *vide Toxicology.*

Medicinal Uses.—This solution is a powerful tonic; it has been given in ague, fever, in periodic headache, in chorea, *epilepsy*, and tic douloureux. It has long *been known as a valuable* remedy in intermittent fevers,

and it sometimes succeeds when all other medicines have failed. Should its administration cause nausea, pain in the stomach, purging, soreness of the mouth, and increased discharge of saliva, or pain across the forehead, the dose ought to be diminished, or the medicine suspended. Orfila states that, when given even in small doses, it produces a disposition to organic disease of the heart. *Dose*, ♏iij. to ♏v., three times a day, gradually increased.

BARII CHLORIDUM (Ba Cl=104).—*Ingredients.*—Carbonate of Barytes, Hydrochloric Acid, Distilled Water.

Remarks.—When the carbonate of barytes is added to hydrochloric acid, the carbonic acid is immediately expelled, and by the reaction of the hydrochloric acid on the baryta, (oxide of barium,) water and chloride of barium are formed.



Properties.—On evaporating the solution, crystals of chloride of barium are deposited. These crystals are in *rhombic plates*, and contain 2 eq. of water, which, however, may be driven off by a moderate degree of heat. The salt itself is not decomposed at a very high temperature.

Officinal Preparation.—Liquor Barii Chloridi.

Medicinal Uses.—It has been employed in scrofulous affections; and is also supposed to be vermifuge. It is used principally as a test for sulphuric acid, or the sulphates.

BISMUTHI NITRAS (BiO_3 NO_5=291).—*Ingredients.*—*Bismuth*, Nitric Acid, Distilled Water.

Remarks.—The bismuth decomposes a portion of *the nitric acid*; the oxygen of the decomposed acid

unites with the bismuth, forming oxide of bismuth, and this combining with the undecomposed nitric acid, forms nitrate of bismuth; during the process, nitric oxide gas is given out. When water is added to the solution of the nitrate, as is directed in the Pharmacopœia, it is immediately resolved into two salts,—a *supernitrate*, which remains in solution, and a *trinitrate*, which is precipitated.

Properties.—This salt is the cosmetic, known as Pearl powder, Blanc d' Espagne, or Magistery of Bismuth, it is white, inodorous, tasteless, insoluble in water, rendered brownish black by hydrosulphuric acid, and is converted by gentle calcination into the yellow oxide of bismuth.

Medicinal Uses.—It has been recommended in cases of gastrodynia, pyrosis, and other painful dyspeptic affections. *Dose*, gr. v. to ʒj.

CALX (Ca O=28).—*Remarks.*—By the action of heat, the carbonic acid of the chalk (carbonate of lime) is driven off, and the lime remains. The lime obtained in this way is much purer than the common lime used in preparing mortar. 100 parts of chalk should furnish 56 of lime, 44 per cent. of carbonic acid being expelled.

Properties.—Pure lime has a fine white colour and an earthy appearance; it has an alkaline taste and produces a burning sensation; it corrodes animal and vegetable substances. It must be kept in well-closed vessels, as it soon attracts moisture and carbonic acid from the air. Water, when poured upon lime, combines with it rapidly, forming *hydrate of lime*, great heat being evolved during the combination, owing to the consolidation of the water. Every 28 parts of lime combine with 9 of water.

Officinal Preparations.—Liquor Calcis, Liquor Ammoniæ, Liquor Potassæ, Potassa cum Calce, Calcii Chloridum.

LIQUOR CALCIS.—*Ingredients.*—Lime, Distilled *Water.*

Remarks.—Only a very small portion of the lime is dissolved by the water; yet the water has a strong styptic taste, and turns the blue infusion of cabbage to a green, and turmeric to a brown. It unites with oils by agitation, forming very imperfect soaps. When exposed to the air, it attracts carbonic acid, forming a carbonate of lime, which is precipitated; hence it must be kept in vessels closely stopped.

Dalton first observed that lime was more soluble in cold than in hot water; a fact which the experiments of Mr. Phillips have confirmed. He has found that—

A pint of water at	32°	dissolves 13·25 grs.	of lime.
Ditto	60°	11·6	ditto
Ditto	212°	6·7	ditto

Medicinal Uses.—Lime water is used as a tonic, antacid, and lithontriptic. As it restrains mucous discharges, it is not unfrequently administered in leucorrhœa and in diarrhœa. Externally, it is applied to sores and ulcers, and in tinea capitis. *Dose*, f ℥ij. to f ℥iv.

CALCII CHLORIDUM (Ca Cl = 56).—*Ingredients.*—Chalk, Hydrochloric Acid, Distilled Water.

Remarks.—When the chalk (carbonate of lime) is dissolved in hydrochloric acid, the carbonic acid is expelled; the hydrogen of the hydrochloric acid combines with the oxygen of the lime to form water; and the chlorine unites with the calcium to form chloride of calcium. The water used in the first instance and that formed by the chemical action are both expelled on the application of the heat directed by the Pharmacopœia.

Properties.—Chloride of calcium is colourless and inodorous; it is soluble in about one and a half times its weight of water; it is very deliquescent, also soluble in alcohol, and imparts a red colour to its flame when it is kindled.

Medicinal Uses.—It has been employed as a tonic and deobstruent in scrofula and glandular affections. *Dose, of the officinal solution*, f ℥ss. to f ℥ij.

CALX CHLORINATA (CaO, ClO Ca Cl = 128).—*Ingredients.*—Hydrate of Lime, Chlorine.

Remarks.—The bleaching salt, or bleaching powder of Mr. Tenant, called, in commerce, chloride of lime, is here designated *chlorinated lime.*

When chlorine gas is passed over hydrate of lime until the latter is saturated, the resulting compound is the *calx chlorinata* of the Pharmacopœia.—(For the process for obtaining chlorine gas from binoxide of manganese and hydrochloric acid, *vide* CHLORINE GAS.)

Properties.—When pure, chloride of lime is white; it emits a faint smell of chlorine, and has a strong taste. It is only partially soluble in water, the uncombined lime being but very slightly soluble. It acts as a powerful bleacher; but when it has been for some time exposed to the air, it suffers decomposition, and at the same time loses its bleaching power. Its bleaching power may be estimated by its decolorising action on sulphate of indigo. When treated with water, the portion taken up is probably a bihydrated chloride of lime.

Medicinal Uses.—It has considerable disinfecting powers, and as such is used in hospitals, &c. It has also been used as an application to putrescent ulcers.

CRETA PREPARATA ($CaO, CO_2 = 50$). — *Remarks.* —Chalk is a native carbonate of lime, seldom found perfectly pure, but generally containing portions of siliceous and argillaceous earths. Different specimens of chalk exhibit different degrees of purity; the kind named "grey" chalk is less pure than the white. By the process of elutriation here directed, the chalk is obtained in a fine powder.

Properties.—It should be in the form of an impalpable powder, and of a white colour. It should dissolve rapidly, with strong effervescence, either in nitric, sulphuric, hydrochloric, or acetic acid, every 100 parts losing, by expulsion of carbonic acid gas, nearly 22 parts.

Officinal Preparations.—Ammoniæ Sesquicarbonas,

Calx, Calcii Chloridum, Hydrargyrum cum Cretâ, Mistura Cretæ, Confectio Aromatica.

Medicinal Uses.—It is used as an antacid and absorbent, and is administered in diarrhœa, when by the purging all irritating matter has been evacuated. As an external application, it acts by absorbing acrid matter from ulcerated surfaces. *Dose*, gr. x to ʒj.

CUPRI AMMONIO-SULPHAS (CuO, $2\ NH_3$, SO_3, $HO = 123$).—*Ingredients.*—Sulphate of Copper, Sesquicarbonate of Ammonia.

Remarks.—During the trituration of the substances employed, effervescence takes place, owing to the excess of carbonic acid in the sesquicarbonate of ammonia being set free. This compound is usually composed of sulphuric acid, oxide of copper and ammonia, the basis being in excess.

Properties.—Its colour is a deep azure blue; its taste is styptic and strongly metallic. Exposed to heat, it emits ammoniacal fumes abundantly.

Officinal Preparations.—Liquor Cupri Ammonio-Sulphatis.

Medicinal Uses.—It is tonic and antispasmodic, and, as such, has been administered in epilepsy and chorea, after a course of purgatives. Brera considers it quite equal to arsenic in the cure of intermittents. *Dose*, gr. ¼, gradually increased to gr. v. twice a day, in the form of pills, made with crumb of bread. The solution is employed as a detergent and mild escharotic. When more diluted, it has been recommended as a stimulant application to the eye, to promote the absorption of specks on the cornea.

FERRI AMMONIO-CHLORIDUM ($Fe_2\ Cl_3$, $2\ NH_3\ HCl$, $2HO = 290$). — *Ingredients.* — Sesquioxide of Iron, Hydrochloric Acid, Hydrochlorate of Ammonia, Distilled Water.

Remarks.—When sesquioxide of iron is dissolved in *hydrochloric* acid, mutual decomposition is effected; the *hydrogen of the* hydrochloric acid unites with the oxygen

of the sesquioxide, and forms water; the disengaged chlorine combining with the iron, forms a *sesquichloride of iron*. The hydrochlorate of ammonia, previously dissolved in distilled water, is now added, and the liquor is then evaporated. In the former edition of the Pharmacopœia, sublimation was directed in this process; but the preparation obtained in that way was of such uncertain strength that evaporation is now substituted.

Properties.—It has an orange-yellow colour, a styptic taste, and, on exposure to the air, it deliquesces. It is very soluble in water, one ounce of this fluid dissolving ʒiv. of it; it is likewise soluble in alcohol.

Officinal Preparations.—Tinctura Ferri Ammonio-Chloridi.

Medicinal Uses.—It is tonic, emmenagogue, and aperient. *Dose*, gr. v. to gr. x.

TINCTURA FERRI SESQUICHLORIDI ($Fe_2 Cl_3 = 164$). —*Ingredients.*—Sesquioxide of Iron, Hydrochloric Acid, Rectified Spirit.

Remarks.—When sesquioxide of iron is dissolved in Hydrochloric Acid, mutual decomposition takes place, as above.

Properties.—This tincture is of a reddish-brown colour, and is highly styptic. The alcohol in it seems to undergo some change, as its odour resembles that of hydrochloric ether.

Medicinal Uses.—This is one of the most active preparations of iron, and it seems to exert a specific influence upon the urinary organs. It is found useful in dysuria, given in doses of ♏x. every ten minutes. It sometimes proves anthelmintic. In hæmorrhage from the bladder, kidneys, or urethra, it acts as a powerful styptic; externally, it is very efficacious in destroying warts; it is also valuable when applied as a styptic to fungus and cancerous sores or to leech bites. *Dose*, ♏x to ♏xxx, in water.

FERRI IODIDUM (*Fe I, 5* HO = 199).—Ingredients. —*Iodine, Iron Filings,* Distilled Water.

Remarks.—The iodine unites with the iron, forming an iodide of iron.

Properties.—The solution of iodide of iron is of a greenish colour; and by evaporation, with as little contact with the air as possible, green tabular crystals are formed. On evaporating to dryness, and applying a gentle heat, this salt is fused, and an opaque crystalline mass, of an iron-grey colour and metallic lustre, remains on cooling. This should be kept in well-stopped vessels, to prevent its absorbing moisture; it is also proper to keep this preparation in a dark place. It is very soluble both in water and in alcohol. When solution of iodide of iron is kept in badly-stopped vessels, sesquioxide of iron is very soon precipitated; but by keeping iron wire immersed in it, and placing it in a well-stopped vessel, it may be kept clear.

Medicinal Uses.—This medicine is a powerful stimulant and emmenagogue. It has been given in cases of general debility, ulceration of the throat, and scrofula. It has also been employed in hysteria, chlorosis, and amenorrhœa. *Dose*, gr. j. to gr. iij.

FERRI POTASSIO-TARTRAS (KO, C_4 H_2 O_5, Fe_2 O_3, C_4, H_2, O_5 = 260).—*Ingredients.*—Sulphate of iron, Sulphuric Acid, Nitric Acid, Solution of Ammonia, Bitartrate of Potash, Distilled Water.

Remarks.—When nitric acid acts upon most metals and some elementary bodies it is converted into oxygen and nitric oxide, the base being oxidised at its expense; the same result occurs in the above, when it converts the protoxide of iron into sesquioxide, which dissolves in the additional sulphuric acid, and forms a solution of sesquisulphate of iron, which, on the addition of ammonia, is decomposed into hydrated sesquioxide of iron and sulphate of ammonia.

When this hydrated sesquioxide of iron is boiled in water with the bitartrate of potash, the excess of acid which this salt contains dissolves the oxide, and a solution is obtained which consists of tartrate of potash

and tartrate of sesquioxide of iron, and this evaporated to dryness, constitutes the potassio tartrate of iron.

Properties.—It is of a brownish-green colour, has a slight styptic taste, and is inodorous. When exposed to the atmosphere, it attracts moisture, but does not deliquesce. It is very soluble in water, and its solution remains a great length of time without undergoing any change. It should be totally soluble in water; it should not have an acid reagency; nor should it be turned blue by ferrocyanide of potassium.

Medicinal Uses.—It is an agreeable preparation of iron, and may be administered with advantage in amenorrhœa arising from debility, or in general atony of the system, especially if a diuretic action is needed at the same time. *Dose,* from v. grs. to xv. grs., dissolved in water, or given in the form of a bolus.

FERRI SESQUIOXYDUM.—*Ingredients.*—Sulphate of Iron, Carbonate of Soda, Boiling Water.

Remarks.—When the solutions of subcarbonate of soda and protosulphate of iron are mixed, double decomposition takes place. The soda attracts the sulphuric acid, forming a sulphate of soda, which remains in solution; the carbonic acid combines with the protoxide of iron, forming a protocarbonate of iron. The protocarbonate of iron thus formed gradually absorbs oxygen from the air, loses its carbonic acid, and becomes a sesquioxide of iron. This preparation always retains some carbonic acid.

Properties.—It should have a deep-brown colour, and should completely dissolve, with slight effervescence, in hydrochloric acid.

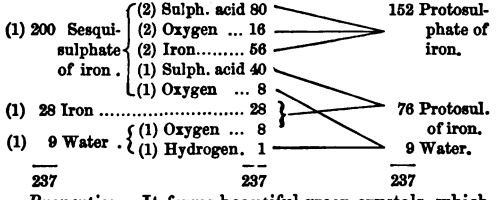
Officinal Preparations.—Ferri Ammonio-Chloridum, Tinctura Ferri Sesquichloridi, Ferri Potassio-Tartras.

Medicinal Uses.—Tonic and emmenagogue. It has been given in neuralgic affections, and in amenorrhœa, combined with myrrh or aromatics. *Dose*, from ℥ss. to ℥j.

FERRI SULPHAS (FeO, SO_3 $7HO = 139$).—In-

gredients.—Sulphate of Iron, Sulphuric Acid, Iron Wire, and Distilled Water.

Remarks.—The sesquisulphate of iron contained in the impure sulphate of iron of commerce is reduced to the state of protosulphate by the sulphuric acid and iron wire. The metallic iron also precipitates any trace of copper which the sulphate may contain. The following diagram shows the changes which take place.



Properties.—It forms beautiful green crystals, which are transparent rhomboidal prisms; its taste is harsh and styptic, and it reddens vegetable blues. It is soluble in two parts of cold and in three-fourths of boiling water. When pure protosulphate, the ferrocyanide of potassium throws down from its solution a perfectly white protoferrocyanide. By exposure to the air, the surface of its crystals becomes of a brownish colour, owing to the protoxide being converted into the sesquioxide of iron. The crystals are composed of one equivalent of the salt, 76, and 7 equivalents of water, 3.

Impurities.—The sulphate of iron of commerce is sometimes contaminated by sulphate of copper. This may be detected by immersing, in an aqueous solution of the salt, a clean plate of iron, on which the copper will be deposited in its metallic state.

Officinal Preparations.—It is used in the preparation of the Ferri Sesquioxydum, Mistura Ferri Composita, and the Pilulæ Ferri Compositæ.

Medicinal Uses.—It is used as a tonic and emmenagogue in amenorrhœa and chlorosis, and it is also supposed to possess some anthelmintic power. When given in an over dose, it occasions vomiting, and griping pains. *Dose*, gr. ii. to v.

FERRI AMMONIO CITRAS.—*Ingredients.*—Sulphate of Iron, Carbonate of Soda, Citric Acid, Solution of Ammonia, and Distilled Water.

Remarks.—The hydrated carbonate of iron formed at first is subsequently converted into a citrate of iron, the excess of acid being neutralised by ammonia, and the protoxide of iron converted into sesquioxide by exposure to the atmosphere.

This salt occurs in brilliant translucent scales, of a garnet-red colour, readily soluble in water, and of a slightly ferruginous taste.

Medicinal Uses.—As a tonic in debility, dyspepsia, &c. *Dose*, gr. v. to gr. x., in water flavoured with syrup of orange.

FERRI CARBONAS CUM SACCHARO.—*Ingredients.*—Sulphate of Iron, Carbonate of Soda, Sugar, and Distilled Water.

Remarks.—This is another of the preparations of iron added to the present Pharmacopœia. As the sugar here exerts a protective influence in this preparation, this is a far more active medicine than the sesquioxide of iron.

Medicinal Uses.—Tonic and chalybeate. *Dose*, gr. iij., ad ʒj.

HYDRARGYRUM CUM CRETA.—*Ingredients.*—Mercury, Prepared Chalk.

Remarks.—During the trituration with the chalk, he mercury becomes reduced to a state of extremely inute subdivision, so that it is fitted for entering the stem more readily.

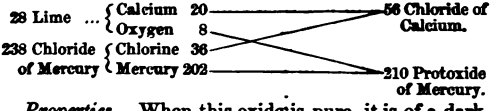
Impurities.—By heat, the whole of the mercury ould be dissipated, and the white residue (chalk) *ould be perfectly soluble* in acetic acid; its solution

in this acid should not be coloured by hydrosulphuric acid.

Medicinal Uses.—It is a mild and good mercurial. It is used as an alterative and absorbent, and has been found useful in mesenteric affections, and in some forms of dysentery. The mildness of this preparation is attributed to the carbonate of lime, by its neutralizing any acidity in the primæ viæ. *Dose*, g. x. to ʒss.

HYDRARGYRI OXYDUM (Hg O = 208).—*Ingredients.*—Chloride of Mercury, Solution of Lime.

Remarks.—This is a case of double elective affinity. The chlorine of the chloride unites with the calcium, forming a chloride of calcium, which remains in solution and is poured off; the oxygen of the decomposed lime combines with the mercury, forming a protoxide of mercury, which is precipitated.



Properties.—When this oxide is pure, it is of a dark colour, and is completely dissolved by acetic acid, it is decomposed by hydrochloric acid, the products being protochloride of mercury and water. If this oxide be exposed to the air at a moderate heat, it absorbs oxygen; but if distilled in a glass retort, its oxygen is evolved. When this preparation has been digested for some time in dilute hydrochloric acid, and strained, neither solutions of potash nor oxalate of ammonia should cause precipitation. The former would prove the presence of binoxide of mercury, if it caused an orange-yellow precipitate; and the latter, if it produced a white precipitate, would show that lime was present.

Medicinal Uses.—It has not been used internally; its properties are variable, as it generally contains *more or less* of the peroxide of mercury, which would *give it much increased activity.*

HYDRARGYRI NITRICO-OXYDUM.—This is the binoxide of mercury, and is the only peroxide of mercury retained in the Pharmacopœia.

Ingredients. — Mercury, Nitric Acid, Distilled Water.

Remarks.—The mercury is first oxidized, and then dissolved by the nitric acid, forming pernitrate of mercury, nitric oxide gas escaping. When a high heat is applied to the pernitrate, the nitric acid is decomposed and driven off, and binoxide of mercury, with a small proportion of pernitrate remains. The red vapours which are produced during the process are, as was stated before, when treating of the preparation of nitrate of silver, caused by the nitrous gas evolved attracting oxygen from the air, and becoming nitrous acid.

Properties.—Its colour is of a bright red, and it exists in the form of small crystalline scales, which are in a very slight degree soluble in water. It is a *binoxide of mercury, with a very small quantity of pernitrate.* Fumes of nitric vapour should not rise on application of heat to this preparation; nor should water in which it has been boiled yield precipitates with hydrosulphuric acid or lime.

Officinal Preparation. — Unguentum Hydrargyri Nitrico-Oxydum.

Medicinal Uses.—It is used externally as an escharotic, and for destroying fungus excrescences.

HYDRARGYRI AMMONIO-CHLORIDUM ($Hg\ Cl,\ NH_2\ Hg\ Cl,\ N\ H_2,\ Hg\ N = 756$).—*Ingredients.*—Bichloride of Mercury, Distilled Water, Solution of Ammonia.

Remarks.—This, according to the most recent view, is composed of equal equivalents of *bichloride* and *binamide* of mercury. (The *binamide* contains two equivalents of *amidogen* and one of mercury.)

When excess of ammonia is added to a solution of bichloride *of mercury, part* of the ammonia is decom-

posed into *amidogen* $N H_2$ and hydrogen. Part of the bichloride is also decomposed into chlorine and mercury. Then 2 eq. of amidogen unite with 1 of mercury and form binamide of mercury; and 2 of chlorine with two of hydrogen to form hydrochloric acid.

2 *ammonia* ($N_2 H_6$) + 1 bichloride of mercury, (Cl_2 Hg.) form
$H_2 + Cl_2 = 2$ *Hydrochloric acid*
$N_2 H_4$ (2 *Amidogen*) + Hg. = 1 *Binamide of mercury.*

The binamide with some undecomposed bichloride, falls as a *white precipitate*, and the hydrochloric acid, with some undecomposed ammonia, forms hydrochlorate of ammonia, which remains in solution.

Properties.—It is in the form of an impalpable powder, of a white colour. Its taste is slightly metallic. It is insoluble in water and in alcohol. It does not become black from the application of the caustic, or fixed alkalies, or alkaline earths, but acquires a yellow colour, its ammonia being evolved.

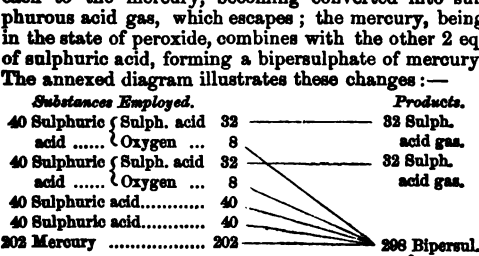
Impurities.—It should be totally vaporized by heat, this proving that it does not contain any fixed impurity. Its solution in acetic acid should not be coloured by iodide of potassium, which will prove that it neither contains starch nor lead. If this powder becomes black on rubbing it with lime water, it shows the presence of calomel. If any carbonate is present, hydrochloric acid causes an effervescence. The characteristic test of this preparation is, that there is no other white substance which, when heated with potash, yields ammonia, and becomes yellow.

Officinal Preparations.—In the form of ointment it is employed in cutaneous affections; it is also used to destroy both the Pediculi Pubis, and the Pediculi Capitis.

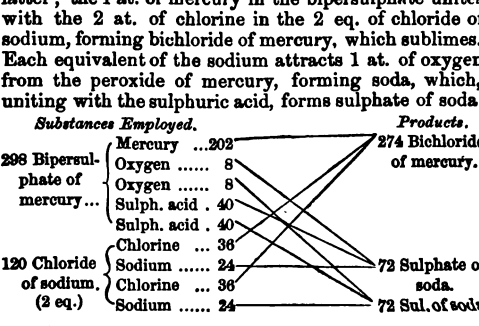
HYDRARGYRI BICHLORIDUM ($Hg Cl_2 = 272$).—*Ingredients.*—Mercury, Sulphuric Acid, Chloride of Sodium.

Remarks.—In preparing the bichloride of mercury, *the first part* of the process consists in forming a bisper-

sulphate of mercury.* Four equivalents of sulphuric acid are requisite to convert 1 eq. of mercury into a bipersulphate; two of these yield one atom of oxygen each to the mercury, becoming converted into sulphurous acid gas, which escapes; the mercury, being in the state of peroxide, combines with the other 2 eq. of sulphuric acid, forming a bipersulphate of mercury. The annexed diagram illustrates these changes:—



The next part of the process is, to heat the bipersulphate of mercury with dry chloride of sodium (common salt), in the proportion of 1 eq. of the former to 2 of the latter; the 1 at. of mercury in the bipersulphate unites with the 2 at. of chlorine in the 2 eq. of chloride of sodium, forming bichloride of mercury, which sublimes. Each equivalent of the sodium attracts 1 at. of oxygen from the peroxide of mercury, forming soda, which, uniting with the sulphuric acid, forms sulphate of soda.



* *That is, a compound of* 2 eq. sulphuric acid with 1 eq. *binoxide of mercury.*

Properties.—It is of a pure white colour, and semi-transparent. Its taste is s yptic, and strongly metallic. It is obtained in the form of a dense mass. When sublimed slowly, it condenses in slender prismatic crystals. It is soluble in nearly 20 parts of water at 60° according to Thenard, but according to Orfila, in 11 parts, and in about 3 parts of boiling water; its solubility in water is increased by the addition of hydrochlorate of ammonia or chloride of sodium. It is also soluble in alcohol, and in sulphuric ether. When pure, it is completely volatilized by heat, and is distinguished from calomel by itssolubility in water, and by its giving a yellow precipitate with lime water. When potash or lime is added to its aqueous solution, a reddish or yellowish precipitate is thrown down, which, on being heated, should evolve oxygen, and the residue should be pure mercury.

Officinal Preparations.—Liquor Hydrargyri Bichloridi, Hydrargyri Binoxydum, Hydrargyri Ammonio-Chloridum.

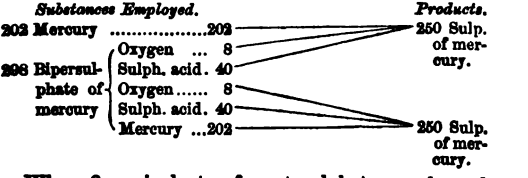
Medicinal Uses.—This, the ancient corrosive sublimate, is the most powerful of the mercurial preparations. Externally applied, it is highly stimulant and escharotic; taken internally, it acts as a stimulant and alterative. In doses of $\frac{1}{8}$ to $\frac{1}{4}$ of a grain it has been found efficacious in secondary syphiloid affections, and in cutaneous diseases of an obstinate character, as in lepra. In large doses it acts as a powerful poison.

LIQUOR HYDRARGYRI BICHLORIDI.—*Ingredients.*—Bichloride of Mercury, Hydrochlorate of Ammonia, Distilled Water.

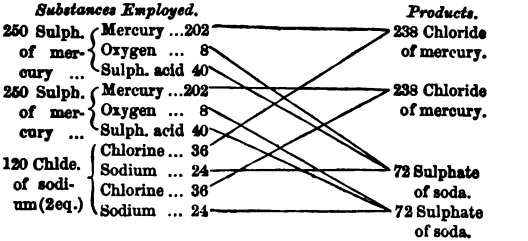
Remarks.—The hydrochlorate of ammonia is employed merely to promote the solubility of the bichloride in water. The *dose* of this solution, which contains $\frac{1}{4}$ of a grain of bichloride in each fluid ounce, is from *f* ℥ss. to *f* ℥ij. in infusion of linseed.

HYDRARGYRI CHLORIDUM (Hg Cl = 236).—*Ingredients.*—Mercury, Sulphuric Acid, Chloride of Sodium.

Remarks.—By boiling mercury and sulphuric acid together, a bipersulphate of mercury is formed in the manner before explained. When this is triturated with the remaining portion of mercury, *two* atoms of protosulphate of mercury are formed.



When 2 equivalents of protosulphate are heated with 2 eq. of the chloride of sodium, the 2 atoms of mercury in the protosulphate unite with the 2 at. of chlorine, to form 2 at. of protochloride of mercury; and the 2 at. of oxygen combine with the 2 eq. of sodium, forming soda, which, with the 2 at. of sulphuric acid, form 2 eq. of sulphate of soda.



By washing the calomel with boiling distilled water, any bichloride that may be present is removed.

Properties.—Chloride, or protochloride of mercury, *(calomel) as obtained by this* process, is a white, semi-

transparent, crystalline mass, tasteless and heavy, and insoluble in water. When exposed to heat, it sublimes unaltered. Calomel does not undergo any change by the action of the air, but it acquires a dark tinge by exposure to light. It is decomposed by the solutions of the fixed alkalies, or alkaline earths, and acquires a black colour.

Impurities.—Calomel should yield a pure black protoxide on the addition of solution of potash; and this black precipitate, on the application of heat, should evolve oxygen, metallic mercury being the residue. Distilled water in which it has been washed or boiled should not yield precipitates on the addition of nitrate of silver, lime water, or hydrosulphuric acid.

Officinal Preparations.—Hydrargyri Oxydum, Pilulæ Hydrargyri Chloridi Compositæ.

Medicinal Uses.—Calomel is more extensively employed than any other article in the Materia Medica. It is purgative, alterative, and antisyphilitic. It is extensively used in inflammatory affections, and is particularly efficacious in acute affections of the serous membranes. In diseases of children, it acts with great benefit, especially in croup and hydrocephalus. Children can generally bear larger doses of this medicine than adults. *Dose*, as an alterative, from gr. ss. to gr. j. night and morning; as a purgative, from grs. ij. to gr. x., or in some cases, even to gr. xv. or ℈j. Its best mode of administration is in the form of pill.

HYDRARGYRI BICYANIDUM* (Cy_2 (C_4N_2) = 52, Hg 202 = 254.—*Ingredients.*—Percyanide of Iron, Binoxide of Mercury, Distilled Water.

Remarks.—When percyanide of iron and binoxide of mercury are boiled together, they react on each other; the cyanogen of the percyanide combines with the mercury, forming a bicyanide of mercury; the *oxygen* of the mercury unites with the iron, forming

* Omitted in present Pharmacopœia.

sesquioxide of iron, which, being insoluble, is precipitated.

Properties.—This salt is poisonous; it has a metallic taste; it is much less soluble in cold than hot water; it is decomposed by hydrochloric acid, the products being bichloride of mercury and hydrocyanic acid.

Officinal Preparation.—It is employed in the preparation of hydrocyanic acid.

HYDRARGYRI IODIDUM (Hg I = 326). — *Ingredients.*—Mercury, Iodine, Alcohol.

Remarks.—When iodine and mercury are rubbed together, direct combination takes place, an iodide of mercury being the resulting compound.

Properties.—This substance is of a greenish-yellow colour, and is insoluble in water. It should be kept in a dark place, as the light tends to decompose this compound, resolving it into mercury and biniodide. When this substance is first prepared, it is of a yellowish colour; and when heat is cautiously applied; it sublimes in red crystals, which afterwards become yellow, and then, by access of light, blacken. It is insoluble in chloride of sodium.

Medicinal Uses.—Emmenagogue, stimulant and absorbent, given in cases of bronchocele, secondary syphilis, and in ovarian dropsy, especially when this affection depends on amenorrhœa. Like other preparations of iodine, it is much commended in scrofulous affections. *Dose*, gr. j. to gr. iij. It is frequently used in the form of ointment, the proportions being ℈j. to the ℥iss. of lard.

HYDRARGYRI BISULPHURETUM (Hg S_2 = 232.)—*Ingredients.*—Mercury, Sulphur.

Remarks.—When mercury and sulphur are exposed to heat (moderate, to prevent the mass from taking fire) the mercury combines with a portion of the sulphur, and by continuing the heat the excess of sulphur is driven off, and the bisulphuret of mercury *is obtained by sublimation.* In this process more sul-

phur is employed than is actually requisite to convert the mercury into a bisulphuret; this is to make up for the loss of a portion of sulphur, which is always dissipated.

Properties.—The bisulphuret of mercury or cinnabar condenses in crystalline cakes, having a radiated appearance and a red colour. It is inodorous, insipid, and insoluble in water, alcohol, acids, and alkalies, although these last substances decompose it when melted with it. It is known in the arts under the names of "*cinnabar*" or "*vermilion.*"

This preparation should be totally driven off by heat; it should not be dissolved by nitric or hydrochloric acids, but should be soluble in nitro-hydrochloric acid. If it contain any *dragon's blood*, it will give a colour to alcohol when digested with it; if any *red lead* is present, it will yield a yellow precipitate on adding iodide of potassium to acetic acid, in which it has been digested.

Medicinal Uses.—It is principally used for the purpose of mercurial fumigation, a small portion of it being placed on a hot iron, while the fumes are directed on diseased parts, or inhaled. Internally in skin disease, in doses of gr. v.

MAGNESIA (CALCINED MAGNESIA) Mg O = 20).—*Ingredient.*—Carbonate of Magnesia.

Remarks.—The carbonic acid of the carbonate of magnesia is driven off on the application of a high heat, and the magnesia remains in a pure state. Magnesia may be obtained also by adding a solution of caustic soda, or potash, to a solution of any of the salts of magnesia. Magnesia is the only oxide of the metal magnesium.

Properties.—Pure magnesia has neither taste nor smell, and does not effervesce with acids. At natural temperatures one part of magnesia requires upwards *of 5000 parts* of water for its solution. Magnesia is *distinguished* from lime by forming a very soluble

compound with sulphuric acid, and by no heat being disengaged when water is poured on it. From the experiments of Dr. Fyfe it appears, that magnesia, like lime, is more soluble in cold than in boiling water.

Medicinal Uses.—It is antacid, and when acidity is prevailing in the stomach it becomes purgative; when the bowels are distended with flatus, it is preferable to the carbonate. *Dose*, from ℈j. to ℥ss. If this substance be taken in large quantities for a long time, it is apt to combine with the mucus of the intestines, and form calculi.

MAGNESIA CARBONAS (Mg O, 2 HO, 4 Mg O, CO^2, HO = 242).—*Ingredients.*—Sulphate of Magnesia, Carbonate of Soda, Distilled Water.

Remarks.—On mixing the solutions of carbonate of soda and sulphate of magnesia, a double decomposition takes place. The carbonic acid of the carbonate unites with the magnesia of the sulphate, forming a carbonate of magnesia, which being insoluble in water, is precipitated, and the soda of the carbonate unites with the sulphuric acid of the sulphate of magnesia, forming a sulphate of soda, which remains in solution.

Properties.—When pure, the carbonate of magnesia is an insipid substance, of a fine white colour, and is not altered by exposure to the air; water does not dissolve above 1–2000th part of it. Its acid is expelled when exposed to a high heat, and is also driven off by almost all other acids.

Impurities.—On the application of the usual tests for hydrochloric or sulphuric acids, there should be no evidence of their presence.

Medicinal Uses.—It is antacid, and if an acid be present in the stomach or bowels, a mild purgative. It is useful in cases of uric acid calculus, or where there appears to be a disposition to the formation of that concretion. *Dose*, ℈j. to ℥j.

PLUMBI ACETAS (SUGAR OF LEAD), (PbO, C_4, H_3,

O_2 3 HO = 190).—*Ingredients.*—Pulverized Oxide of Lead, Acetic Acid, Distilled Water.

Remarks.—When acetic acid is mixed with oxide of lead, it combines with it, forming acetate of lead; and on evaporation, crystals of this salt are obtained.

Properties.—Acetate of lead occurs in masses of minute, needle-shaped crystals; its taste is sweet and astringent. It is soluble in alcohol, and dissolves in four times its weight of water. Its crystals contain three atoms of water, and form, in appearance, *right oblique-angled prisms.* Acetate of lead is decomposed by a solution of any carbonate or sulphate; hence it forms a white turbid compound with most kinds of spring or pump water, which contain sulphate and carbonate of lime.

Impurities.—Acetate of lead ought to be entirely dissolved by distilled water free from carbonic acid. Should anything remain insoluble, it is an impurity. Carbonate of soda should cause a white precipitate, the carbonate of lead; iodide of potassium should cause a yellow one, the iodide of lead. Hydrosulphuric acid causes a black precipitate, the hydrated sulphuret of lead; and by heat, pyroacetic acid should be evolved, and metallic lead remain.

Officinal Preparations.—Ceratum Plumbi Acetatis, Liquor Plumbi Diacetatis.

Medicinal Uses.—Taken internally, it acts as a sedative and astringent, and is given with advantage, combined with opium, in hæmoptysis; however, it must be used with great caution, as it is poisonous. Externally, its solution in water is used as a collyrium in ophthalmia; as an astringent injection, in gonorrhœa; and as a lotion, to moderate inflammatory action. *Dose,* gr. ss. to gr. j.

LIQUOR PLUMBI DIACETATIS. — Acetate of Lead, Oxide of Lead, Water.

Remarks.—When the acetate of lead is boiled with *the oxide, as is* here directed, the acetic acid takes up an

additional quantity of the oxide, and the resulting compound is a solution of the diacetate of lead, which is composed of one atom of acetic acid = 51, 2 atoms of oxide of lead $112 \times 2 = 224$; weight of its atom = 275.

This is known by the name of "Goulard's Extract."

Properties.—It is of a greenish straw colour, or is colourless. It has an austere, rather sweetish taste; and when kept, deposits some oxide, and becomes of a lighter colour. When evaporated sufficiently, and allowed to cool, it deposits crystals, having the form of *flat rhomboidal prisms, with dihedral summits.*

Impurities.—This preparation is often made with the residuum of the distillation of vinegar, and, from the vegetable impurities which that residuum contains, the preparation has a brownish dark colour, and ought to be rejected.

Officinal Preparation.—Liquor Plumbi Diacetatis Dilutus.

Medicinal Uses.—It is only used externally in superficial inflammations of the skin.

LIQUOR PLUMBI DIACETATIS DILUTUS.—Solution of Diacetate of Lead, Distilled Water, and Proof Spirit.

PLUMBI IODIDUM (PbI = 230).—*Ingredients.*—Acetate of Lead, Iodide of Potassium, Distilled Water.

Remarks.—The oxygen of the oxide of lead unites with the potassium, forming potash, which combines with the acetic acid to form acetate of potash; the iodine is transferred to the lead, forming an iodide of lead, which is precipitated.

Properties.—Iodide of lead is of a yellow colour, sparingly soluble in cold water, but freely dissolves in boiling. It is also soluble in solution of potash.

Medicinal Uses.—It is occasionally used in the form of an ointment.

PLUMBI OXYDUM HYDRATUM.—*Ingredients.*—Solution of Diacetate of Lead, Distilled Water, Solution of Potash.

Remarks.—*The potash* unites with the acetic acid,

forming acetate of potash, which remains in solution; the oxide of lead is precipitated in combination with some water, constituting the *hydrated oxide of lead.*

Properties.—Hydrated oxide of lead is a white powder, soluble in excess of potassa and in nitric acid; it is blackened by hydrosulphuric acid and the hydrosulphurets.

Pharmaceutical Use.—It is employed in the preparation of the Quinæ Disulphas.

LIQUOR POTASSÆ (KO = 48).—*Ingredients.*—Carbonate of Potass, Lime, Boiling Distilled Water.

Remarks.—In this process the lime unites with the carbonic acid, forming a carbonate of lime, which is precipitated, and the potass remains in solution.

Properties.—Solution of potash is colourless and inodorous; it is caustic, and when rubbed between the fingers it feels soapy, in consequence of a partial solution of the cuticle; it is strongly alkaline. This solution must be kept in green bottles, as it acts on white glass, and these must be kept well closed, to prevent its attracting carbonic acid from the atmosphere. When united with oil, it forms a soap, which is soluble both in alcohol and in water. Its sp. gr. should be 1·063.

Impurities.—The usual tests for carbonic, hydrochloric, or sulphuric acids, should not give evidence of their presence. Chloride of platinum should throw down from this, as well as from all the salts of potash, a yellowish precipitate.

Officinal Preparations.—Potassæ Hydras, Potassa cum Calce, Antimonii Oxysulphuretum.

Medicinal Uses.—It is antacid, diuretic, alterative, and lithontriptic. As an antacid, it is used in skin diseases, psoriasis, boils, &c., attended with acidity of the stomach and urine. As a lithontriptic, it is used in those cases where there is a deposition of a red sediment in the urine, which indicates the presence of *uric acid.* Its dose is from ɱx. to ʒss., largely diluted.

LIQUOR POTASSÆ CARBONATIS.—*Ingredients.*—Carbonate of Potash, Distilled Water.

Remarks.—This solution has a sp. gr. of 1·473; it is colourless and inodorous. Its dose is from f 3ss. to 3j. diluted with water. From the nauseous taste of this solution it is seldom used internally, the bicarbonate of potash being preferred. It is chiefly employed in pharmacy.

POTASSA CUM CALCE.—*Ingredients.*—Hydrate of Potass, Lime.

Remarks.—When these substances are rubbed together, a granular compound is formed, which consists of the *hydrates* of *lime* and *potass* mixed, but not in chemical combination.

Medicinal Uses.—This admixture renders the potass more manageable as a caustic, as it is less deliquescent, and therefore less liable to extend its action beyond the part to which it is applied.

POTASSÆ HYDRAS (KO, HO=57).—*Remarks.*—By evaporating down liquor potassæ to dryness, and fusing the mass which remains by the gradual application of heat, increased until it liquefies, and then pouring it into iron moulds, the caustic potass, or the *hydrate of potass*, is obtained. An iron vessel is directed to be used, because the caustic potass would act powerfully on glass, earthenware, and some of the metals. Silver vessels are sometimes used.

Properties.—When the hydrate of potass is prepared in iron vessels, it always contains a portion of peroxide of iron mixed with it, which imparts to it a brownish tint. When it is dissolved in water, the peroxide of iron is precipitated. If, however, it be prepared in a silver vessel, it is of a greyish-white or white colour. A portion of the potassa, during fusion, acts oxygen from the air, and forms peroxide of potassium. This excess of oxygen is evolved in the gaseous form when the potassa is dissolved in water. It *is highly deliquescent*, it must be kept in well-

stopped bottles; this also prevents its attracting carbonic acid from the air. It is soluble in alcohol, and is powerfully alkaline. This substance is composed of one equivalent of potass and one of water, from which it cannot be separated by a bright-red heat.

Medicinal Uses.—The hydrate of potass is a powerful escharotic, and is used in the formation of issues, but owing to the chemical action of the alkali on the cutaneous tissue, it is liable to produce a larger eschar than is in most cases requisite. It differs much from nitrate of silver, which destroys a mere film.

POTASSÆ ACETAS (KO, C_4 H_3, O_3=99).—*Ingredients.*—Carbonate of Potass, Acetic Acid, Distilled Water.

Remarks.—The acetic acid having a greater affinity for the potass than the carbonic, combines with it, forming acetate of potass, and the carbonic acid escapes. The evaporation of the salt is to be conducted with care until the water is expelled, and the salt becomes a crystalline mass on cooling.

Properties.—This salt has a foliated laminar texture, and is extremely deliquescent; hence it must be kept in well-closed vessels. It has a sharp and pungent taste. It is very soluble in water, and is also dissolved by alcohol. By a high temperature it is completely decomposed, and is converted into carbonate of potass. The usual tests for sulphuric or hydrochloric acids should not give evidence of the presence of these acids.

Medicinal Uses.—It is diuretic in small doses, and proves laxative in larger ones. It has been used in dropsies, where it is desirable to promote the urinary excretion without heating the system. *Dose*, ℈j. to ʒj. as a diuretic; ʒij. to ʒiij. as a cathartic.

POTASSÆ CARBONAS (SALT OF TARTAR), (KO CO_2= 70). — *Ingredients.* — Impure Carbonate of Potass (Pearl-ash), Distilled Water.

Remarks.—The "pearl-ash" of commerce consists *of the ashes* of vegetables, which contain impure car-

bonate of potass, and other earthy and saline matters, chiefly hydrochlorate, pyrolignate, and sulphate of potass, and silica. As the carbonate is more soluble than any of the other salts contained in the pearl-ash, it is dissolved by the water, and the greater part of the impurities is left. A purer carbonate of potass is obtained by decomposing the bitartrate of potass by heat. In this case the tartaric acid is burned, and its elementary constituents either escape in the form of carbonic acid, carburetted hydrogen, and pyrotartaric acid, or remain as carbon and oxygen, forming carbonic acid, combined with the potassa and charcoal. By solution, filtration, and evaporation, the carbonate is obtained free from impurities.

Properties.—This salt is inodorous and colourless, very soluble in water, and extremely deliquescent; hence it must be kept in well-closed vessels, to prevent its becoming liquid. Its taste is alkaline and disagreeable; its solution renders the infusion of red cabbage green, and changes paper tinged by turmeric to a reddish brown. It is insoluble in alcohol. It contains about 16 per cent. of water.

Impurities.—The impurities of carbonate of potass are generally small portions of hydrochloric or sulphuric salts. By saturating it with nitric acid, and adding to different portions of the neutral compound thus formed solutions of chloride of barium and nitrate of silver, the presence of these acids may be detected. These salts, however, are seldom present in sufficient quantity to render the carbonate of potass unfit for most of the uses to which it is applied.

Officinal Preparations.– Liquor Potassæ Carbonatis, Liquor Potassæ, Potassæ Acetas, Potassæ Sulphas, Potassæ Tartras, Potassii Sulphuretum, Liquor Potassæ Arsenitis, Spiritus Ammoniæ, Spiritus Ammoniæ Aromaticus, Spiritus Ammoniæ Fœtidus, Decoctum Aloes Compositum, Mistura Ferri Composita, Pilulæ *Ferri Compositæ.*

Medicinal Uses.—Antacid and diuretic. It is seldom used, as the bicarbonate is preferred, being more agreeable and less liable to cause nausea. Its chief use is for making saline draughts. *Dose*, gr. x. to ʒss.

POTASSÆ BICARBONAS ($KO\ 2CO_2,\ HO = 101$).—*Ingredients.*—Carbonate of Potash, Chalk, Sulphuric Acid, Distilled Water.

Remarks.—The carbonate of potass consists of one atom of each of its constituents; and the salt obtained by this process is a bicarbonate, consisting of two atoms of carbonic acid and one atom of potass. Chalk consists of lime and carbonic acid. When the sulphuric acid is added to the chalk, a sulphate of lime is formed, and carbonic acid is disengaged. By passing this through a solution of the carbonate of potass in Nooth's or Woolfe's apparatus, it converts the salt into a bicarbonate. The solution must be evaporated by a gentle heat, as its excess of acid is expelled by a high temperature.

Properties.—This salt crystallizes in four-sided prisms, with dihedral summits. Its taste is but slightly alkaline; and its solution has but a slight effect on the infusion of blue cabbage. It is soluble in a little less than four parts of water at 60°, and in five-sixths its weight of boiling water: by this, however, it is decomposed, a portion of its carbonic acid being driven off. It is insoluble in alcohol.

Impurities.—This salt should dissolve, without any residue, in diluted nitric acid; and its solution in this acid should not become turbid on the addition of solutions of nitrates of baryta or silver. It should not precipitate the salts of magnesia.

Medicinal Uses.—This salt being more mild than the carbonate offers an agreeable and efficient remedy in those cases in which the use of an alkali is indicated. It is used as an antacid and lithontriptic, and is found *particularly* efficacious in disordered states of the *digestive functions*, especially those connected with acidity.

It is used in the formation of effervescing draughts; and it is preferred for this purpose, owing to the large proportion of carbonic acid it contains. *Dose*, gr. x. to ʒss.

LIQUOR POTASSÆ EFFERVESCENS.—*Ingredients.*—Bicarbonate of Potass, Distilled Water.

Remarks.—When carbonic acid gas is passed through a solution of bicarbonate of potass, and pressure is employed, the *effervescing solution of potash* is obtained. This solution must be kept in well-stopped vessels. It is commonly known as *potass water.*

POTASSÆ SULPHAS (POLYCHREST SALT), ($KO\ SO_3$ = 88).—*Ingredients.*—The Salt which remains after the Distillation of Nitric Acid.

Remarks.—This salt is a bisulphate of potass—that is, it contains 2 atoms of sulphuric acid, combined with one of potassa. When it is ignited in a crucible the excess of sulphuric acid is driven off, and a neutral sulphate of potass remains.

Properties.—This salt is colourless and inodorous. Its primary form is a *right rhombic prism*, but by spontaneous evaporation it crystallizes in six-sided pyramids. These crystals do not contain any water of crystallization; they are slightly efflorescent, and decrepitate when heated. This salt is soluble in sixteen parts of cold water, and in five parts of boiling. It is insoluble in alcohol. It is a most eligible substance for reducing powders into a minute state of division, owing to its hardness and insolubility.

Officinal Preparations.—Pulvis Ipecacuanhæ Compositus.

Medicinal Uses.—It is often employed as a purgative for children in combination with rhubarb or jalap, and in doses of from gr. v. to xxx. For adults the dose is ʒij. In very large doses it acts as an irritant poison.

POTASSÆ BISULPHAS ($KO,\ SO_3,\ HO_3$ = 146).—Ingre-

dients.—The Residual Salt of the distillation of Nitric Acid, Sulphuric Acid, Boiling Water.

Remarks.—This salt is a bisulphate of potass, mixed with a little sesquisulphate. The use of the sulphuric acid is to convert any sesquisulphate which may be present into a bisulphate.

Properties.—This salt crystallizes in hexangular prisms, which have an acid taste, and are soluble in twice their weight of water. It is also soluble in alcohol.

Medicinal Uses.—As the sulphuric acid predominates in this salt, it must possess, in a greater or less degree, the properties assignable to that acid; and when it is desirable to administer an aperient salt with this acid, this salt is generally preferred. It has been administered with advantage conjoined with rhubarb. *Dose*, gr. x. to ʒij.

Potassæ Tartras (Soluble Tartar), (KO, $C_4 H_5 O_5$=114).—*Ingredients.*—Bitartrate of Potass, Carbonate of Potass, Boiling Water.

Remarks.—When carbonate of potass is added to the bitartrate, one atom of the tartaric acid of the bitartrate unites with the potass of the carbonate, and the carbonic acid is expelled; the bitartrate having yielded one atom of its tartaric acid to the potass of the carbonate, two equivalents of neutral tartrate of potass are formed.

Properties.—This salt has a bitter taste, is very soluble in water, being dissolved by its own weight of that fluid at the temperature of 60° F., when in the crystalline state; but in its granular form, as it is generally kept in the shops, it requires four parts of water for its solution. This salt has received the name of *soluble* tartar, in consequence of its great solubility compared with that of the bitartrate. It is soluble in alcohol. When exposed to a moist atmosphere it *deliquesces* slightly. Its solution is decomposed by *long keeping.*

Medicinal Uses.—Tartrate of potass is a mild and cooling purgative. Combined with resinous purgatives it counteracts their griping qualities, by accelerating their solution and operation. *Dose*, ʒj. to ʒj., in solution.

POTASSII BROMIDUM (K Br.).—*Ingredients.*—Bromine, Carbonate of Potass, Iron Filings, Distilled Water.

Remarks.—When bromine and iron are mixed in water, and a gentle heat is applied, the bromine unites directly with the iron, forming a bromide of iron. When carbonate of potass is added to the solution of bromide of iron, the oxygen of the potass (oxide of potassium) combines with the iron, forming an oxide of iron, with which the carbonic acid unites, forming carbonate of iron, which is precipitated. The bromine combines with the potassium, forming a bromide of potassium, which remains in solution.

Properties.—*Bromide of potassium* is colourless and inodorous; its crystals, which are in cubes or quadrangular prisms, are anhydrous; it has a pungent taste, is very soluble in water, and but slightly so in alcohol.

Medicinal Uses.—It has been commended in scrofula, and in chronic enlargements of the spleen. *Dose*, gr. j. to gr. vj. twice or three times a day.

POTASSII IODIDUM (KI=166).—*Ingredients.*—Iodine, Carbonate of Potass, Iron Filings, Distilled Water.

Remarks.—Precisely the same changes take place in the preparation of iodide of potassium as in the process for obtaining the bromide of potassium, the iodine being substituted for bromine.

Properties.—Iodide of potassium is colourless and inodorous; its crystals, which are in cubes, are anhydrous. Water at 65° dissolves nearly 1½ time its weight; it is nearly insoluble in absolute alcohol, but diluted *alcohol takes up a large* proportion of it.

Impurities.—The crystals should be totally soluble in water, and its solution should not affect litmus or turmeric. The crystals being anhydrous, should not lose weight by the application of heat. Sulphuric acid and starch added together should produce a blue colour.

Medicinal Uses.—In secondary syphilis, scrofula, and skin disease, with sarsaparilla, in doses of gr.j.—v. ter die. It is powerfully diuretic, and may be detected in the tears and other secretions by adding sulphuric acid, and then a cold solution of starch.

LIQUOR POTASSII IODIDI COMPOSITUS.—*Ingredients.*—Iodide of Potassium, Iodine, Distilled Water.

Remarks.—The iodide of potassium is capable of taking up a further portion of iodine, and rendering it soluble in water; the compound thus formed is called the *ioduretted iodide of potassium.*

POTASSII SULPHURETUM.—*Ingredients.*—Sulphur, Carbonate of Potash.

Remarks.—When the carbonate of potash and sulphur are heated together, the carbonic acid of the carbonate is driven off, and three-fourths of the oxide of potassium, or potassa, are decomposed. Its oxygen unites with a portion of the sulphur to form sulphuric acid; and this uniting with the undecomposed one-fourth of potassa, forms sulphate of potassa. The recent researches of MM. Fardos and Gelis show this view to be erroneous; as, when heated with alcohol, no trace of sulphate of potash remains in the residual salt. The sulphuret of potassium of the Pharmacopœia is not a definite compound, but consists of a mixture of persulphuret of potassium and hyposulphate and carbonate of potash.

Properties.—This substance is hard, and of a liver-brown colour; hence its former name of *Hepar sulphuris.* Its taste is acrid and bitter. When dry, it *is inodorous,* but if moistened, it yields a stench of *hydrosulphuric* acid.

Medicinal Uses.—It is principally employed externally in cutaneous diseases. Its solution has lately been recommended as a lotion for the psoriasis of infants; and in some cases it has succeeded after the sulphur ointment has failed. It is seldom or never used internally, and in large quantities it is poisonous.

SODÆ CARBONAS ($Na\ O,\ CO^2,\ 10HO = 144$).—*Ingredients.*—Impure Carbonate of Soda, Distilled Water.

Remarks.—"Impure soda" is the term generally applied to *kelp*, or *barilla*, which are impure carbonates of soda. Barilla is the product of the incineration of the *salsola soda* and the *salicornia herbacea* on the southern coasts of France, Spain, and Portugal; and the kelp is obtained from the incineration of the *fuci* in Holland, and on the coasts of France and Scotland. By solution, evaporation, and crystallization of either of these substances, the carbonate of soda is obtained in a state of considerable purity. Carbonate of soda is also procured, on a large scale, from common salt. This is treated with sulphuric acid, and subjected to heat, whereby the salt is decomposed, and converted into a sulphate of soda, and hydrochloric acid gas is driven off. The sulphate of soda is then calcined with sawdust and other carbonaceous matters, whereby its sulphuric acid is driven off, and converted into sulphuric acid and oxygen, whilst the carbon becoming converted into carbonic acid unites with the soda to form carbonate of soda. This salt was formerly termed the *subcarbonate*.

Properties.—Carbonate of soda is soluble in two parts of cold water, and in less than its own weight of boiling water. Its crystals effloresce on being exposed to the air, and fuse when heated, losing their water of crystallization, of which the common carbonate generally contains ten or eleven equivalents. Carbonate of soda is *sensibly alkaline*; it changes the vegetable *colours to a green.*

Impurities.—This salt often contains an admixture of common salt and the sulphate of soda; these may be detected by converting the carbonate into a nitrate, and then adding to separate portions of the solution nitrate of silver and nitrate of baryta: if the former give a precipitate, it is owing to the presence of common salt; if the latter, to a sulphuric salt. This salt should be perfectly soluble in water, and totally insoluble in alcohol.

Pharmaceutical Uses.—It is used in preparing the Ferri Sesquioxydum, Pilulæ Ferri Compositæ, Magnesiæ Carbonas.

Medicinal Uses.—It is used as an antacid and as a lithontriptic in cases of uric acid calculus. It has been used in pertussis after the bowels have been evacuated, at first, combined with ipecacuanha and opium, and when the cough has diminished in severity, with Peruvian bark. *Dose*, gr.x. to ʒss. three times day.

SODÆ CARBONAS EXSICCATA, NaO, $CO_2 = 54$.—*Remarks.*—By the application of the heat in the first part of the process, a large proportion of the water is driven off; the expulsion of the water is completed when the salt is subjected to ignition. This salt, when properly prepared, is anhydrous.

Medicinal Uses.—Mixed with soap, it is given in the form of pills as a lithontriptic. It is preferable to the crystallized salt, because the latter effloresces, so that the pills prepared from it lose their cohesion very soon. *Dose*, gr. v. to gr. xv.

SODÆ SESQUICARBONAS.—*Remarks.*—This process is similar to that employed for the preparation of the potassæ bicarbonas. This salt is a *sesquicarbonate*, and is composed of—

3 atoms of carbonic acid	$22 \times 3 = 66$
2 atoms of soda	$32 \times 2 = 64$
4 atoms of water.....	$9 \times 4 = 36$

Properties.—This salt is much less soluble than the carbonate, and exists in the state of minute crystals, the form of which has not been ascertained. When exposed to a red heat, it loses part of its carbonic acid, and is reduced to the state of a carbonate. This salt has been found native near Ferrari, in Africa. It is commonly called *trona*, or *natron*.

Impurities.—It should not yield a precipitate on the addition of chloride of platinum or sulphate of magnesia. The former would indicate the presence of potash, the latter would indicate that the proper quantity of carbonic acid was not present.

Medicinal Uses.—From its mild taste, it is best adapted to those cases in which the use of an alkaline carbonate is indicated; and in this form a larger quantity of soda can be administered than under the ordinary carbonate. *Dose*, gr. x. to ʒss.

SODÆ BICARBONAS ($NaO, 2CO_2, HO = 85$).—This salt is manufactured on a large scale, by exposing crystals of carbonate of soda to a continued current of carbonic acid gas, which they absorb with the evolution of heat and a large quantity of aqueous vapour. It may also be prepared by passing a current of carbonic acid gas into a strong solution of carbonate of soda, when the bicarbonate falls as a crystalline arenaceous powder.

Medicinal Uses.—Similar to those of the Carbonate. *Dose*, gr. x. to gr. xxx.

SODÆ SULPHAS (GLAUBER'S SALT), ($NaO, SO_3, 10HO = 162$).—*Ingredients.*—The Residual Salt after the distillation of Hydrochloric Acid, Boiling Water, Carbonate of Soda.

Remarks.—This residual salt was before stated to consist of sulphate of soda, with a small portion of bisulphate, formed by the excess of sulphuric acid used in the process combining with a part of the sulphate. When the carbonate is added, the soda of the *carbonate neutralizes* the excess of acid in the portion

of bisulphate, forming a neutral sulphate, and the bonic acid escapes.

Properties.—It crystallizes in hexahedral pri which are soluble in about three parts of water at and in less than one-third of their weight of wate 90°; however, when the temperature is incre beyond that point, its solubility diminishes. By k ing a saturated solution of sulphate of soda at a temperature, crystals may be obtained, which do contain any water of crystallization. The com crystallized sulphate contains ten equivalents of wa these fuse on being exposed to heat, and part their water of crystallization. By exposure to the this salt effloresces.

Medicinal Uses.—It used to be employed as a gative; but from its bitter taste, and the naus is liable to occasion, it is now seldom used. sulphate of magnesia is generally substituted it.

SODÆ POTASSIO-TARTRAS (ROCHELLE SALTS, OR DE SEIGNETTE), (KO, $C_2H_2O_5$, Na O $C_4H_2O_5$, 8H 284). — *Ingredients.* — Bitartrate of Potass, C nate of Soda, Boiling Water.

Remarks.—The excess of tartaric acid in the t trate unites with the soda of the carbonate, and carbonic acid escapes. The neutral tartrate of and potass in combination remains in solution. V the solution is evaporated until a pellicle app large prismatic crystals are formed.

Properties.—Its colour is a pure white; it f crystals of great size and regularity, often in the of *right-sided prisms, with flat terminations at angles to the axis of the prism.* It is soluble in times its weight of water at 60°, and in much water at its boiling point.

Impurities.—The usual tests for sulphuric or h *chloric acids* should not give evidence of their *sence.* This salt should not affect litmus or tur

Medicinal Uses.—This salt is a mild purgative, and enters into the composition of Seidlitz powders. *Dose*, from ʒj. to ʒss. In smaller doses, it is powerfully diuretic, and renders the urine alkaline.

LIQUOR SODÆ CHLORINATÆ.—*Ingredients.*—Carbonate of Soda, Distilled Water, Chloride of Sodium, Binoxide of Manganese, Sulphuric Acid.

Remarks.—In this process, when the chlorine, which is evolved by the action of sulphuric acid on chloride of sodium and binoxide of manganese, is passed through a solution of carbonate of soda, it is absorbed by the solution, and forms the *disinfecting chloride of soda of Labarraque.*

The chlorine is passed through water before it is admitted into the solution of carbonate of soda, in order that any hydrochloric acid that is present may be absorbed by the water.

It appears, from the experiments of Faraday, that no carbonic acid is disengaged in preparing this compound, although the chlorine is very readily absorbed; but when chlorine is passed in *excess* into a solution of carbonate of soda, the carbonic acid is expelled, and a mixture of chloride of sodium and chlorate of soda is produced.

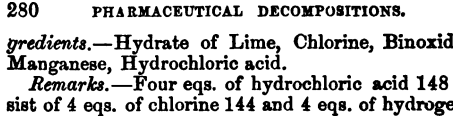
Properties.—Labarraque's liquid has but little odour of chlorine; its taste is at first sharp, saline, scarcely at all alkaline, but it has a persistent, astringent, biting taste upon the tongue. It does not give out chlorine on ebullition, which proves that chlorine must be more in the state of combination than in the ordinary state of solution. This fluid deteriorates by keeping, and is decomposed by slow crystallization of the salt.

Medicinal Uses.—This fluid is celebrated as an antiputrescent, and as such is used in typhoid affections; it is also employed in form of a lotion to bad ulcers.

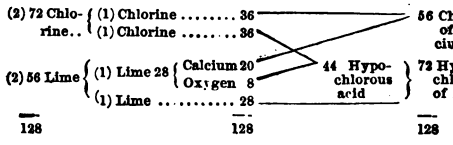
CALX CHLORINATA (Ca O, Cl O, Ca Cl = 128).—In-

gredients.—Hydrate of Lime, Chlorine, Binoxide of Manganese, Hydrochloric acid.

Remarks.—Four eqs. of hydrochloric acid 148 consist of 4 eqs. of chlorine 144 and 4 eqs. of hydrogen 4; 2 eqs. of binoxide of manganese, of 4 eqs. of oxygen 32, and 2 eqs. of manganese 56. The following changes occur :—



When the liberated chlorine comes into contact with the slaked lime, the following changes occur :—



Properties.—Chlorinated lime is a white or brownish-white powder, which has a peculiar odour, and has a bitter, astringent, and acid taste ; it is partially soluble in water.

Pharmacopœia Use.—Chlorœ formyl.

Medicinal Uses.—Antiseptic and disinfectant—the solution is employed in gangrenous and fœtid sores.

CALAMINA PREPARATA. — *Remarks.* — Calamine is an impure ore of zinc, known in commerce by the name of "Lapis Calaminaris." It consists of carbonic acid united with oxide of zinc ; it often contains, also, some foreign oxides, and frequently a small portion of the oxide of cadmium. The process here directed merely effects its reduction to a subtle powder, and fits it for use as an external application.

Properties.—Its colour is reddish-yellow, or buff. It has an earthy appearance. It dissolves slowly, with effervescence, in diluted sulphuric or nitric acids. On adding ammonia to either of these solutions, oxide of zinc is thrown down.

Medicinal Uses.—It is sometimes sprinkled over sores to absorb the fluids secreted therefrom, and to dry their surfaces. It is also employed in the form of the ceratum calaminæ.

ZINCI OXYDUM (Zn O = 40).—*Ingredients.*—Sulphate of Zinc, Sesquicarbonate of Ammonia, Distilled Water.

Remarks.—This is a case of double elective affinity, the sulphuric acid combining with the ammonia, forming a sulphate of ammonia, while the greater portion of the carbonic acid unites with the oxide of zinc, forming a carbonate of zinc, which is precipitated. The excess of carbonic acid of the sesquicarbonate is evolved during the process. When the carbonate of zinc thus formed is subjected to a high heat, the carbonic acid is expelled, and oxide of zinc remains.

Properties.—Oxide of zinc is of a white colour, inodorous, and tasteless; it fuses when exposed to a strong heat; it is insoluble in water, but is dissolved by most acids, and also by the solutions of potass, soda, and ammonia, but not by their carbonates. When oxide of zinc is heated nearly to redness, it becomes yellow, and on cooling again becomes white, by which it may be known from most white powders. Oxide of antimony, however, is similarly affected.

Impurities.—If it contain white lead or chalk, dilute sulphuric acid will not dissolve the adulterating substances, but insoluble sulphates will be formed, with effervescence.

Officinal Preparation.—Unguentum Zinci.

Medicinal Uses.—It is tonic and astringent. *Dose,* gr. j. to gr. v. twice a day, in the form of pill, in *chorea and epilepsy.* It is sometimes applied exter-

nally, in the form of powder, to promote the drying of excoriated and exuding surfaces.

ZINCI SULPHAS (WHITE VITRIOL), (ZnO, SO_3 $7HO = 143$).—*Ingredients.*—Zinc, in small pieces; Diluted Sulphuric Acid.

Remarks.—In this process the water is decomposed; its oxygen unites with the zinc, forming oxide of zinc; the oxide is then dissolved by the sulphuric acid, making a sulphate of zinc. The hydrogen of the water is disengaged with effervescence. The sulphate of zinc is obtained, by evaporation, in quadrilateral prismatic crystals, which contain seven equivalents of water.

Properties.—Sulphate of zinc is nearly transparent and colourless. It is but little altered by exposure to the air, and its taste is strongly metallic. If sulphate of zinc be pure, its solution does not yield traces of oxide of iron, nor become blue on adding to it water of ammonia, which would show the presence of copper.

Officinal Preparations.—Zinci Oxydum, Liquor Aluminis Compositus.

Medicinal Uses.—In doses of from gr. x. to ℈ij. it is a powerful emetic, and it is often used to evacuate the stomach when poison has been taken, since it acts directly, with no straining or nausea. It is given as a tonic and astringent, in doses of from gr. j. to gr. iij., in epilepsy and chorea. It is used as an injection in gonorrhœa and fluor albus. The solution is employed as an external astringent to restrain hæmorrhage.

MISTURA FERRI COMPOSITA.—*Ingredients.*—Myrrh, Carbonate of Potash, Rose Water, Sulphate of Iron, Spirit of Nutmeg, Sugar.

Remarks.—In this preparation a double decomposition takes place; the carbonic acid of the carbonate of potash unites with the protoxide of iron in the sulphate, forming protocarbonate of iron; and the sulphuric acid unites with the potassa, forming a sulphate of potassa. The carbonate of iron thus produced is

diffused through the mixture, and kept suspended by means of the saponaceous compound formed by the union of the excess of alkali with the myrrh; by which excess, also, part of the carbonate of iron is dissolved. The sulphate of potash serves to correct the astringent influence which iron is apt to exert on the bowels.

Properties.—When recently prepared, this mixture is of a greenish colour, owing to the presence of protocarbonate of iron, the protoxide of iron in which, however, rapidly abstracts oxygen from the air, becoming converted into the sesqui, or peroxide. To prevent this, it is directed to be kept in well-stopped vessels; it is better, however, that the preparation should be made extemporaneously. Its change of colour indicates impairment of its efficacy.

Medicinal Uses.—This mixture is nearly the same as the celebrated *Antihectic Mixture* of Dr. Griffith. It is employed in hectic fever, in some forms of phthisis, and in chronic diarrhœa. The affection in which it is most permanently serviceable is chlorosis, and the numerous sympathetic affections connected with it. *Dose*, from f ℥j. to f ℥ij. once or twice a day.

Pilula Ferri Composita.—*Ingredients.*—Myrrh, Carbonate of Soda, Sulphate of Iron, Treacle.

Remarks.—In this case, as in the preceding preparation, an interchange of acids occurs, the carbonic acid combining with the iron, and the sulphuric acid with the soda. These pills should be prepared extemporaneously.

Medicinal Uses.—The same as those of the Mistura Ferri Composita.

Alcohol.—*Ingredients.*—Rectified Spirit, Chloride of Calcium.

Remarks.—Rectified spirit, of the sp. gr. of 0·840, contains 17 per cent. of water, to free it from which *is the object of the* above process. The chloride of

calcium having a great affinity for the water, combines with it; when the mixture is subjected to distillation, the spirit distils over, and the chloride of calcium remains in the retort, with nearly all the water. Other deaquating substances are employed, as lime, baryta, and dried carbonate of potash.

Properties.—The purest alcohol that has been obtained by any process has a sp. gr. of 796 at 60° F. This has been termed *absolute* alcohol, on the supposition that it does not contain any water. It has been stated, however, that Lovitz and Saussure succeeded in obtaining alcohol at the sp. gr. of 791. It is a limpid, colourless fluid, of a penetrating odour, and a hot and pungent taste. It is highly volatile, boiling, when its sp. gr. is 820, at the temperature of 176° F.; and when its density is 810, it boils at 173·5,° but has never been rendered solid by exposure to any cold, either natural or artificial. Like other volatile liquids in general, it produces a considerable degree of cold during evaporation. It is highly inflammable, and burns with a lambent, yellowish-blue flame. Its colour varies considerably, according to the strength of the alcohol, the blue tint predominating when it is strong, the yellow when it is diluted.*

Chevreau and Robiquet state, that if alcohol be well deprived of water, on putting a fragment of anhydrous caustic baryta into it, it will remain entire; if, however, it contain but a very small proportion of water, the baryta immediately deliquesces.

Medicinal Uses.—Alcohol, in its concentrated state, can scarcely be said to be employed in medicine. It is chiefly used for pharmaceutical purposes.

SPIRITUS AMMONIÆ.—*Ingredients.*—Hydrochlorate of Ammonia, Carbonate of Potash, Rectified Spirit, Water.

Remarks.—This is a case of double decomposition.

* *For the* eq. no. and composition of alcohol, *vide* p. 196.

The carbonic acid of the carbonate unites with the ammonia of the hydrochlorate, forming carbonate of ammonia, which, being a volatile salt, is vaporized with the spirit, and is condensed in the receiver. The disengaged hydrochloric acid and potash unite, forming water and chloride of potassium, which remains in solution.

Properties.—Spirit of ammonia is a transparent colourless fluid, of an acrid taste and pungent smell. It differs from the ammoniæ sesquicarbonas, in containing a true carbonate, composed of one atom of each of its constituents.

Medicinal Uses.—Given internally, it is a highly diffusible stimulant, and is chiefly used in languors, flatulent colic, and nervous affections. It is also diaphoretic and antispasmodic. Applied externally, it is rubefacient; and when conjoined with camphor, it forms a highly stimulating liniment.

As precisely the same chemical changes occur in the preparation of the SPIRITUS AMMONIÆ AROMATICUS, and the SPIRITUS AMMONIÆ FŒTIDUS, they do not require separate notices. Suffice it to say, that any additional properties they may possess to the foregoing preparation, depend on the accessary stimulant and antispasmodic ingredients.

A TABLE OF INCOMPATIBLES.

Medicinal Substances.	*Incompatibles.*
ACID (CITRIC)	Sulphuric and Nitric Acids, Acetate of Lead, Alkaline, Earthy and Metallic Carbonates; all alkaline substances and solutions, as those of Ammonia, Soda, Magnesia, Lime, Barytes, &c., &c. Tartrate of Potassa.
ACID (HYDROCYANIC)	Oxides of Mercury and Anti-

Medicinal Substances. *Incompatibles.*

mony, Nitrate of Silver, Mineral Acids, Chlorine, the Sulphurets.

ACID (NITRIC)—Oxides, Earths, Alkalies, and their Carbonates, Acetate of Lead, Sulphates of Zinc and of Iron, Acetate of Potassa, Essential Oils.

ACID (SULPHURIC)—Metallic Oxides, some of the Earths, their Carbonates, and the Alkaline Carbonates, Solutions of Acetate of Lead, Chlorides of Calcium and of Barium, Essential Oils.

ACID (TARTARIC)—Alkaline Solutions, Magnesia, Lime Water, Tartrate of Potassa, Acetate of Lead, Salts of Mercury, Vegetable Astringents.

AMMONIÆ SESQUICARBONAS.—Acids, Fixed Alkalies, and their Carbonates, Lime, Magnesia, Alum, Bitartrate of Potassa, Acidulous Salts, Sulphates of Magnesia, Zinc, and Iron; Acetates of Mercury and Lead; Protochloride and Bichloride of Mercury.

AMMONIÆ HYDROCHLORAS.—Sulphuric and Nitric Acids, Fixed Alkalies and their Carbonates, Lime, Magnesia, Acetate of Lead, Nitrate of Silver, Sulphates of Magnesia, Zinc, and Iron.

AMMONIÆ ACETATIS LIQUOR.—Acids, Fixed Alkalies, Lime, Magnesia, Alum, Lime Water, Bichloride of Mercury, Sulphate of Magnesia, Nitrate of Silver, Sulphates of Zinc, Copper, and Iron, Acetate of Lead.

ANTIMONII POTASSIO-TARTRAS—Mineral Acids, Alkalies, and their Carbonates, Hydrosulphates, Earths, Metals, Soaps, Infusions or Decoctions of the Vegetable Astringents.

N.B. From these the Infusions of *Gentian, Wormwood and Quassia* are excepted.

ARGENTI NITRAS—Fixed Alkalies, Alkaline Earths, Sulphuric, Hydrochloric, and Tartaric Acids, and *all* Salts that contain them; Hydrosulphates, *Arsenic* Soaps, Undistilled Waters, Astringent Vegetable Infusions.

Medicinal Substances. *Incompatibles.*

COLUMBA (INFUSION OF)—Infusion and Decoction of Yellow Cinchona Bark, Infusion of Nutgalls, Acetate of Lead, Lime Water, Bichloride of Mercury.

CAPSICUM (INFUSION OF)—Infusion of Nutgalls, Bichloride of Mercury, Nitrate of Silver, Acetate of Lead, Sulphates of Copper, Zinc, and Iron, Alum, Carbonate of Potassa, Ammonia.

CATECHU—Alkalies and their Salts, Metallic Salts, especially those of Iron.

CINCHONA (INFUSION OR DECOCTION OF)—Salts of Iron, Sulphate of Zinc, Potassio-tartrate of Antimony, Bichloride of Mercury, Nitrate of Silver, Arsenical Solutions, Infusion of Nutgalls, Lime Water, Alkaline Carbonates.

COLOCYNTHIDIS PULPA—Nitrate of Silver, Sulphate of Iron, Fixed Alkalies, Acetate of Lead.

CUPRI SULPHAS—Alkalies and their Carbonates, Tartrate of Potassa, Acetate of Lead, Biborate of Soda, Acetate of Ammonia, Chloride of Calcium, Bichloride of Mercury, Nitrate of Silver, Astringent Vegetable Infusions.

CUPRI AMMONIO-SULPHAS—Acids, Fixed Alkalies, Lime Water.

CUSPARIA (INFUSION OF)—Mineral Acids, Sulphates of Iron and Copper, Bichloride of Mercury, Nitrate of Silver, Acetate of Lead, Potassio-tartrate of Antimony, Potassa, Infusions of Nutgalls and Yellow Cinchona.

DATURA STRAMONIUM—Mineral Acids, Salts of Iron, Silver, and Mercury.

DIGITALIS (INFUSION OF)—Acetate of Lead, Sulphate of Iron, Infusion of Yellow Cinchona Bark.

FERRI AMMONIO-CHLORIDUM—Alkalies and their Carbonates, Lime Water, Astringent Vegetable Infusions.

FERRI SULPHAS—Alkalies and their Carbonates, Earths, Hydrochlorate of Ammonia, Nitrate of *Potassa, Biborate* of Soda, Acetate of Ammonia,

Medicinal Substances. *Incompatibles.*

Tartrate of Soda and Potassa, Nitrate of Silver, Acetate of Lead, Soaps, Astringent Vegetable Infusions.

FERRI SESQUICHLORIDI (TINCTURA) — Alkalies and their Carbonates, Mucilage of Gum Arabic, Astringent Vegetable Infusions.

FERRI POTASSIO-TARTRAS—Strong acids, Hydrosulphate of Potassa, Lime Water, Astringent Vegetable Infusions.

GALLS (INFUSION AND TINCTURE OF)—Metallic Salts, especially those of Iron, Acetate of Lead, Potassio-tartrate of Antimony; Sulphates of Zinc and Copper, Nitrates of Mercury and Silver, Bichloride of Mercury, Carbonate of Soda and Potassa, Lime Water, Sulphuric and Hydrochloric Acids, Gelatine.

GENTIAN (COMPOUND INFUSION OF)—Acetate of Lead, Sulphate of Iron.

GUAIACUM—Mineral Acids.

GUM ACACIA (MUCILAGE OF)—Acetate of Lead, Alcohol, Sulphuric Ether, Tincture of Sesquichloride of Iron, Nitric Acid, some Metallic Salts.

HYDRARGYRI BICHLORIDUM—Fixed Alkalies, Alkaline Carbonates, Potassio-tartrate of Antimony, Lime Water, Nitrate of Silver, Acetate of Lead, Sulphuret of Potassium, Sulphur, Soaps, Iron, Lead, Metallic Mercury, Copper, Bismuth, Zinc, Volatile Oils, Astringent Vegetable Infusions.

HYDRARGYRI CHLORIDUM—Alkalies and their Carbonates, Lime Water, Soaps, Sulphurets of Potassium and Antimony, Chlorine, Iron, Lead, Copper, Nitric Acid.

HYOSCYAMUS (TINCTURE OR INFUSION OF)—Nitrate of Silver, Acetate of Lead, Sulphate of Iron.

IPECACUANHA—Vegetable Astringents, Infusion of *Galls, &c.*; Vegetable Acids, especially the Acetic.

KINO— Vide Gallæ.

Medicinal Substances.	*Incompatibles.*
LIQUOR CALCIS	Alkaline and Metallic Salts, Borates, Tartrates, Citrates, Acids, Spirituous Preparations, Sulphur, Astringent Vegetable Infusions.
LIQUOR CALCII CHLORIDI	Sulphuric Acid, Sulphates, fixed Alkalies, Alkaline Carbonates.
LIQUOR PLUMBI DIACETATIS	Alkalies, Alkaline Carbonates, Sulphates and Sulphurets, Undistilled Water, Mucilaginous Fluids.
MAGNESIÆ CARBONAS	Acids, Acidulous Salts, Alkalies and Neutral Salts, (?) Bitartrate of Potassa, Alum, Nitrate of Silver, Acetates of Lead and Mercury, Bichloride of Mercury, Sulphates of Zinc, Iron, and Copper.
MAGNESIÆ SULPHAS	Fixed Alkalies, Alkaline Carbonates, Lime Water, Chlorides of Barium and Calcium, Hydrochlorate of Ammonia, Acetate of Lead, Nitrate of Silver.
MORPHIA (SALTS OF)	Alkalies, Alkaline Carbonates, Magnesia, Lime, Nitrate of Silver, Astringent Vegetable Infusions and Decoctions.
MOSCHUS (SOLUTIONS OF)	Bichloride of Mercury, Nitrate of Silver, Sulphate of Iron, Infusion of Yellow Cinchona Bark.
OLEUM AMYGDALARUM	Acids, Syrups of Squills and Poppies, Oxymel, Supersulphate of Potassa, Tartrate and Bitartrate of Potassa, Bichloride of Mercury, Resins, Hard Water.
OPIUM	Ammonia, Alkaline Carbonates, Nitrate of Silver, Bichloride of Mercury, Acetate of Lead, Sulphates of Iron, Zinc, and Copper, Infusion of Nutgalls.
PLUMBI ACETAS	Alkalies, Alkaline Earths and their Carbonates, Alum, Borax, Sulphates, Hydrochlorates, most Acids, Soaps, Sulphurets; Potassio-tartrate of Antimony, Tartarized and Ammoniated Iron, Undistilled Waters, Astringent Vegetable Infusions.
POTASSÆ ACETAS	Mineral Acids, Decoctions of Ta-

Medicinal Substances. *Incompatibles.*

marinds, Bichloride of Mercury; Alkaline, Acid, or Metallic Neutral Salts; most Sub-acid Fruits.

POTASSÆ BICARBONAS—Mineral Acids, Acidulous Salts, Borax, Hydrochlorate of Ammonia, Alum, Sulphate of Magnesia, Lime Water, Acetate of Lead, Ammonio-sulphate of Copper, Potassio-tartrate of Iron, Potassio-tartrate of Antimony, Chloride of Iron, Proto and Bichlorides of Mercury, Sulphates of Iron, Copper, Zinc, &c.

POTASSÆ NITRAS—Sulphuric Acid, Sulphates of Soda and Magnesia, Alum, Metallic Sulphates.

POTASSÆ CARBONAS—*Vide* POTASSÆ BICARBONAS.

POTASSÆ SULPHAS—Mineral Acids, Salts of Lime, Bichloride of Mercury, Nitrate of Silver, Acetate of Lead.

POTASSÆ BITARTRAS—Mineral Acids, Alkalies, and Alkaline Earths.

POTASSÆ TARTRAS—All Acids and Acidulous Salts, Magnesia, Baryta, and Lime, Nitrate of Silver, Acetate of Lead, Acidulous Fruit, Tamarinds.

RHEUM (INFUSION OF)—Strong Acids, Potassio-tartrate of Antimony, Acetate of Lead, Bichloride of Mercury, Sulphates of Iron, and Zinc, Gelatine, Infusions of Yellow Cinchona, Cusparia, Catechu, Galls, &c.

SODÆ POTASSIO-TARTRAS — Acids, Acidulous Salts, Tamarinds, Sulphates of Soda, Potassa and Magnesia, Acetate of Lead, Hydrochlorate of Ammonia, Salts of Lime, and Baryta.

N.B. Bitartrate of Potassa forms an exception.

SODÆ BIBORAS—Acids, Earthy Sulphates and Chlorides, Potassa, Ammonia.

SODÆ CARBONAS—Same as POTASSÆ BICARBONAS.

SODÆ SULPHAS—Same as MAGNESIÆ SULPHAS.

TARAXACUM—Bichloride of Mercury, Acetate of Lead, *Sulphate* of Iron, Nitrate of Silver, Infusion of *Galls*.

Medicinal Substances. *Incompatibles.*

TORMENTILLA—Alkalies and Alkaline Earths, Salts of Iron, Solution of Isinglass.

VALERIAN—Salts of Iron, Infusion of Yellow Cinchona.

ZINCI SULPHAS—Alkalies, Earths, Hydrosulphates, Milk, Astringent Vegetable Infusions, and Tinctures.

N.B. Many of the substances put down here as *incompatibles*, although they may be so in a *strictly chemical* sense, yet may be combined, and make excellent medicines.

PART IV.

MATERIA MEDICA.

ABIETIS RESINA. *Thus, Frankincense.*—The juice which exudes spontaneously from the spruce fir (*Pinus Abies*) hardens into brittle masses, brownish or yellowish externally, internally of lighter colour, having but little smell, but an acrid and somewhat bitter taste. The greater part of it is imported from Canada, but a smaller quantity of a purer description comes from France. It is composed of a resin and volatile oil, the common composition of the *turpentines* or exuded juice of the coniferæ.

Medicinal Uses.—Rubefacient and discutient. It is used in the preparation of plasters.

Officinal Preparations.—Empl. Galbani—Empl. Opii—Empl. Picis—Empl. Ferri—Empl. Potassii Iodidi.

ABSINTHIUM — ARTEMISIA ABSINTHIUM (Wormwood). — Syngenes. Polygam. superfl. Nat. Ord. Compositæ, Indigenous.

Common wormwood is a perennial plant, growing in dry waste places, and flowering in August. The greater part of that employed in medicine is cultivated in gardens.

The leaves and flowering tops, which are the parts employed in medicine, should be gathered in July and August. The active parts of the plant seem to be a bitter, resinous matter, an azotized bitter principle, and a volatile oil. Braconnot has discovered a peculiar acid in this plant, which he terms *absinthic;* it exists *in* combination with potash, which alkali is very abundant *in* every part of the plant.

Medicinal Uses.—Tonic and anthelmintic. It has

been administered in intermittents, gout, scurvy, dyspepsia, &c. Applied externally, it is said to be discutient and antiseptic. *Dose*, of the powder, from ℈j. to ℈ij.; of the infusion (made by macerating ℥vj. of the plant in f ℥xij. of boiling water), f ℥j. three times a day.

ACACIA—ACACIA VERA (Gum Arabic).—Polygam. Moncec. Lomentaceæ, *Linn.*; Leguminosæ, *Juss.* Africa.

Gum is a proximate vegetable principle, which is obtained by exudation from a number of plants. The greater part of the gum-arabic of commerce is imported from Barbary, being the produce of Morocco, and principally of the mountains of Atlas.

Gum exudes from the bark of the trunk and branches of the tree, in the form of a viscid pellucid juice, which hardens by exposure to the air and sun. The purest gum of the shops is in small irregular pieces, white or yellowish, semi-pellucid, without taste or odour. Other varieties of gum have a yellow or red colour, and are sometimes named Gum Senegal.

Gum appears to be the product of disease; for in the hottest seasons, and from the most sickly trees, the greatest quantity is procured. It is insoluble in alcohol or oils, is soluble in some vegetable acids, but is decomposed by the strong mineral acids, very soluble in water, with which it forms a viscid solution, termed mucilage. Its composition is stated at p. 175.

Mr. Willis has found that the root of the common blue bell, the *hyacinthus non scriptus*, dried and powdered, affords a mucilage possessing all the qualities of that from gum-arabic.

Medicinal Uses.—Gum is employed as a demulcent, in catarrh, strangury, and ardor urinæ. In pharmacy it is used to suspend heavy powders, and to diffuse oils, balsams, and resins in water; it is also employed to give tenacity to pills.

Officinal Preparations.—Mistura Acaciæ—Mistura Moschi—Mist. Guaiaci.—Pulv. Cretæ Comp.—Pulv. *Tragac. Comp.*

ACETOSELLA, OXALIS ACETOSELLA (Wood Sorrel).—Decand. Pentagyn. Gruinales, *Linn.*; Geraniaceæ, *Juss.* Indigenous.

The leaves of this plant yield, on pressure, a juice which is strongly acid. This is owing to the presence of *binoxalate of potash.*

Medicinal Uses.—Owing to their acidity, the leaves of sorrel have been used as a refrigerant, under the form of a whey, made by boiling them in milk.

ACIDUM ARSENIOSUM (White Arsenic), (As O^3 = 100) is obtained by sublimation in the roasting of various metallic ores, especially those of cobalt, in which arsenicum exists. In the chimneys of the furnaces where this operation is conducted, it generally condenses in thick semitransparent masses; though sometimes it assumes the form of a powder, or of little needles, in which state it was formerly called "flowers of arsenic." The sublimate, at first impure, is rendered fit for use by a second sublimation.

For Medicinal Uses, Properties, &c., see the Officinal Preparation, LIQUOR POTASSÆ ARSENITIS.

ACONITI FOLIA ET RADIX, ACONITUM PANICULATUM (Aconite, Monk's-hood, or Wolf's-bane)—Polyand. Trigyn. Multisiliquæ, *Linn.*; Ranunculaceæ, *Juss.* Europe, America.

The leaves (which should be gathered when the flowers appear) have a faint narcotic odour, and a subacrid taste. The smell is lost by drying them. This powerful poison is sometimes gathered and eaten as horseradish. Its active principle is *aconitina*, a process for the preparation of which is given in the Pharmacopœia.

Medicinal Uses.—Aconite is a narcotic and diaphoretic. It was employed by Stoerk in chronic rheumatism, paralysis, ulceration, and scirrhus. Dr. Ducan recommends it in sciatica. Dose, of the leaves, gr. j. to gr. iij.; of the extract, gr. ¼ to gr. ½.

Officinal Preparations.—Extract. Aconiti—Aconitina.

ACORUS, ACORUS CALAMUS (Sweetflag).—Hexand. Monog. Piperitæ, *Linn.*; Aroideæ, *Juss.* Indigenous.

The *rhizome* of the sweetflag has a faint aromatic smell and a warm bitterish taste. As kept in the shops, it is soft, flat, and jointed. It consists chiefly of gum, resin, inuline, volatile oil, and benzoic acid.

Medicinal Uses.—It is a tonic, aromatic, and stimulant, but is used rather as a perfume than as a medicine.

ADEPS, SUS SCROFA (Common Hog).—The Lard.

The fat of the common hog when freed, by melting, from the membranous fibre in which it is contained, and allowed to cool, has all the characters of animal fat. Lard often contains a little salt, from which it should be separated by washing, or melting it with water. Lard consists of two distinct principles; viz., *elaine and stearine.*

Medicinal Uses.—Emollient; chiefly used in the preparation of ointments; it is sometimes added to poultices to prevent their drying and becoming hard.

ÆRUGO, VERDIGRIS. — An Impure Diacetate of Copper, is prepared by covering copper plates with the husks of grapes, after the expression of the juice in the wine-press. A number of plates with the interposed husks being placed together, and being occasionally moistened, the vegetable matter undergoes the acetous fermentation; at the same time the copper attracts oxygen from the air, becoming an oxide, and the acetic acid uniting with it forms diacetate of copper. The incrustations formed on the plates of copper are scraped off and beat into masses, which are dried.

Verdigris is composed of 2 CuO, C_4 H_3 O_3, 6 HO = 185.

Medicinal Uses. — Tonic, astringent, and emetic. Used externally, it acts as a detergent and escharotic.

Officinal Preparation.—Linimentum Æruginis.

ALLIUM — ALLIUM SATIVUM (Garlic). — Hexand. Monog. Liliaceæ. *Linn. Juss.* South of Europe.

Garlic is a perennial bulbous plant, found wild in Sicily, and cultivated in most parts of Europe for culinary purposes. The bulbs, when fresh, have a fetid smell and acrid taste, which are extracted by watery infusion; but are destroyed by decoction. By distillation, a thick ropy essential oil, heavier than water, is obtained.

Medicinal Uses. — It is a diuretic, diaphoretic, and expectorant; and has been given in dropsies, asthma, dyspepsia, rheumatism, hooping cough, and intermittent fevers. Bruised and applied externally, it acts as a rubefacient. *Dose*, ℈j. to ℈ij., swallowed whole, or made into pills with soap.

ALOES—ALOE SPICATA (Spiked Aloes).—Hexand. Monogyn. Liliaceæ. *Linn., Juss.* Asia, Africa, America.

Aloes is a concrete gum-resinous juice, of which several varieties are met with in the shops, differing in purity and qualities. The London College says it is procured from the *aloe spicata*, but it is probably procured from many other species likewise.

The best aloes is the expressed juice of the leaves of the plant, which is inspissated by exposure to the sun and air. It is imported in small pieces of a reddish-brown colour, nearly black in the mass, but when reduced to powder, it is yellowish. The inferior kind is obtained by cutting the plant into pieces, and boiling in water; the decoction is then evaporated to the consistence of honey, when it is poured into large gourd shells, in which it becomes concrete.

Aloes has been analysed by various chemists, who have found sundry principles in it, called *aloesin*, &c. &c. But the best practical piece of analytical information is, that it consists of one portion, soluble in *water; and* another, which is deposited as a light *brown viscid* substance, quite inert.

Of the kinds of aloes met with in the market, the Socotrine is thought to be the finest; it should have an aromatic smell and a bright rich colour. The Cape aloes is dark and brittle, like common resin. The Barbadoes is the most valuable as to price, and the most active as a medicine; it is generally imported in gourds, and is not so easily pulverized.

Medicinal Uses.—It is a stimulating cathartic, emmenagogue, and anthelmintic. In small doses, it acts as a tonic; it is given in cases of habitual costiveness, hypochondriasis, jaundice, and cases generally where there is a sluggish tendency in the intestinal canal. It acts specifically on the colon and rectum, and uterus in the female.* It is contra-indicated in cases of hæmorrhoids; it is also regarded as an improper medicine during the period of utero-gestation, or in menorrhagia. *Dose*, as a tonic, gr. ¼ to gr. i.; as a purgative, from gr. i. to gr. v.; larger doses act no better.

Officinal Preparations. — Decoct. Aloes Comp. — Enema Aloes Purificat.—Extract. Colocynth. Comp. — Pil. Aloes Comp.—Pil. Aloes cum Myrrha—Pil. Gambog. Comp.—Pil. Rhei Comp.—Pil. Sagap. Comp. —Pulv. Aloes Comp.—Tinct. Aloes—Tinct. Aloes Comp.—Tinct. Benz. Comp.—Vinum Aloes.

ALTHÆÆ FOLIA ET RADIX—ALTHÆA OFFICINALIS (Marsh Mallow). — Monadelph. Polyand. Columniferæ, *Linn.*; Malvaceæ, *Juss.* Indigenous.

All parts of this plant yield a mucilage by aqueous infusion or decoction, but the root does so most abundantly. The mucilage thus obtained is used for the same purposes as that obtained from linseed, to which it is preferred in consequence of being purer. It contains a crystallizable matter at one time called

* The action of this drug on the large intestines has been attributed to its *slow solubility*; but this is absurd, for aloes dissolve readily enough; and it has the same action on the large bowel if absorbed from a wound.

Altheine, but which is now shown to be *Asparagin*.

Officinal Preparation.—Syrupus Althææ.

AMMONIACUM—DOREMA AMMONIACUM (Ammoniac).—Pentand. Digynia. Umbelliferæ. Persia.

On the authority of Willdenow, the *heracleum gummiferum* was stated as the plant from which this substance is obtained; it is now admitted, that the *Dorema* is the true source of the drug.

At a certain period of the growth of this plant, it is attacked by a horned beetle, which perforates the stem with its horn, producing a wound, from which the juice exudes.

Ammoniacum is imported in three forms:—1st, the purest, which is in small round fragments or tears; 2nd, in masses; 3rd, in a granular state. It is partly soluble in water, alcohol, ether, and dilute acetic acid. Triturated with water, it forms a milky-like mixture, from which a resinous matter subsides. According to Bucholz, it consists of gum, resin, bassorin, and a volatile oil.

Medicinal Uses.—It is a stimulating expectorant, and as such is used in cases of chronic catarrh, and chronic asthenic bronchitis; in which cases, it is generally combined with squill or ipecacuanha, or sometimes with dilute nitric acid;—and administered with the preparations of iron, it is said to act as an emmenagogue. Externally, it is applied under the form of plaster to scirrhous tumours, and to white swellings of the joints. *Dose*, gr. x. to ℈j.

Officinal Preparations.—Emplas. Ammon.—Empl. Ammon. cum Hydrarg.—Mist. Ammoniac.—Pil. Scillæ Comp.

AMMONIÆ HYDROCHLORAS (*Sal Ammoniac*)—($NH_4Cl = 54$)—originally imported from Egypt, is now *artificially* prepared. It may be obtained from refuse *animal matter* by destructive distillation; also from *soot or gas liquors*.

An abundant product from these substances is carbonate of ammonia, which is condensed in an apparatus, and then subjected to the action of sulphate of lime; an interchange of acids takes place, a soluble sulphate of ammonia remaining in solution, and an insoluble carbonate of lime being precipitated. This solution is next to be treated with chloride of sodium; a sulphate of soda remains in solution, and a hydrochlorate of ammonia is deposited. The two salts are separated by crystallization and sublimation. It requires 3·25 times its weight of water at 60°, and its own weight of water at 212°, for its solution. During its solution, a considerable reduction of temperature takes place.

Medicinal Uses.—Seldom used internally, although it is highly praised by foreign physicians as a febrifuge in doses of gr. v.—xxx.; externally, its solution in water is much employed as a refrigerating lotion.

Officinal Preparations.—Ammoniæ Sesquicarb.—Liquor Ammoniæ — Spir. Ammoniæ, Aromat. et Fœtidus.

AMYGDALA AMARA ET DULCIS—AMYGDALUS COMMUNIS (Almond).—Icosand. Monog. Pomaceæ, *Linn.*; Rosaceæ, *Juss.* The Kernels; Syria, Barbary.

The two varieties of almond—the one bitter, the other sweet—are the products of the kernel of the same tree, growing in different situations. According to Boullay, 100 parts of the sweet almond consist of fixed oil 54, albumen 24, sugar 6, gum 3, lignin 4, water and acetic acid 4. In addition to the above, bitter almond contains a substance called *amygdaline*, which, on contact with water, is decomposed into a volatile oil and hydrocyanic acid.

Medicinal Uses.—When the external rind of the sweet almond is removed by immersion in warm water, and the almond is triturated with water, the oily matter becomes diffused in the water by means of the *albuminous matter*, and a milky-like fluid (almond

milk or emulsion) is formed, which is used as a demulcent, particularly to prevent strangury, during the application of a blister, and for the exhibition of castor oil and other nauseous medicines. The essential oil of bitter almonds acts like hydrocyanic acid. Two cases are said to have occurred at Montpelier of children being poisoned by the use of bitter almonds. It yields from eight to fourteen per cent. of hydrocyanic acid.

Officinal Preparations.—The preparations of the sweet almond are Confect. Amygd. Mist. Amygdal.—Ol. Amygdal.

AMYLUM—TRITICUM HYBERNUM (Common Wheat).—Triand. Digyn. Gramineæ, *Linn.* The Fœcula of the Seeds.

For the description of starch, and the manner of separating it, see p. 175.

Medicinal Uses.—Nutritive and demulcent. It is seldom used medicinally, except in the form of an enema, in which case it is generally combined with the tincture of opium. The anodyne enema thus formed has been used in irritable affections of the bladder, uterus, and urethra.

Officinal Preparation.—Pulv. Tragacanthæ, Comp.—Enema Opii.

ANETHUM — ANETHUM GRAVEOLENS (Dill) — Pentand. Digyn. Umbelliferæ, *Linn.* The Fruit or Seeds.

This is an annual plant, a native of Spain or Portugal, and is cultivated in most countries of Europe. The seeds which are imported contain a volatile oil, on which their properties chiefly depend.

Medicinal Uses.—Aromatic, stimulant, and carminative; much used in the nursery.

Officinal Preparation.—Aqua Anethi.

ANISUM—PIMPINELLA ANISUM (Anise).—Pentand. Digyn. Umbelliferæ, *Linn.* The Fruit or Seeds. Egypt.

This plant is cultivated in the South of Europe, and also in our gardens. Its seeds have an aromatic odour

and a warm taste. These properties depend on a volatile oil, which exists in the envelope of the seed. The seed itself contains a bland fixed oil.

Medicinal Uses.—Stimulant, aromatic, and carminative; given to children troubled with flatus. The best form of administration is, to drop a little oil on sugar, and give a small quantity of this to the child.

Officinal Preparations.—Ol. Anisi—Spir. Anisi.

ANTHEMIS—ANTHEMIS NOBILIS (Chamomile).—Syngenes. Polygam. Superfl. Compositæ. Corymbiferæ, *Juss.* The Flowers. Indigenous.

The flower of this herb, collected before it is fully expanded and dried, is the part employed in medicine. The single-flowered is preferable to the double, in consequence of the odour and taste not residing in the white petals, but in the disk or tubular florets, which are larger in the single flowers. They have a bitter nauseous taste and a strong odour, both of which, in a more or less degree, they impart to water and to alcohol. They contain a volatile oil, bitter, extractive resinous matter, some tannin, and *piperine.*

Medicinal Uses.—Tonic and stomachic, and as such has been much employed in dyspepsia. The warm infusion in some cases causes vomiting, and is used to promote the action of emetics. The flowers, boiled in warm water, are employed as a fomentation to inflamed parts. The extract is a good bitter in the form of pill; it is also used as a convenient vehicle for forming metallic tonics into pills. *Dose*, of the infusion, f ℥j. to ℥iv.; of the extract, gr. v. to gr. xv.

Officinal Preparations.—Inf. Anthemid. Extract. Anthem.

ANTIMONII TERSULPHURETUM (late Sesquisulphuretum)—(Sb_2S_3=177)—occurs native, and is the ore from which the metal is procured. It is separated from the stony matter with which it is mixed by exposing the ore to a heat in a crucible with an aperture *in the bottom, another* crucible being placed below

it to receive the melted metal as it flows out. It is of a dusky white colour, very brittle, and of a plated or scaly texture. Its sp. gr., according to M. Brisson, is 6·7021; but Bergman makes it 6·86. As generally imported from Germany and France, it contains small quantities of lead, arsenicum, and iron.

Officinal Preparations. — Antimonii Oxysulphuretum — Antimonii Potassio-Tartras — Pulv. Antimonii Comp.

ARGENTUM.—The silver of commerce is procured chiefly from ores of native silver, of sulphuret of silver, or from those of lead containing portions of this metal. Ores of native silver, mixed with much stony matter, are reduced to powder on a large scale by machinery, and agitated with mercury and water in a barrel. The mercury combines with the silver, and forms an amalgam, which is separated from the stony matter, and the mercury is then removed by distillation, the silver being left.

Officinal Preparation.—Argenti Nitras.

ARMORACIA — COCHLEARIA ARMORACIA (Horse-radish).—Tetradynam. Siliculosa, *Linn.*; Cruciferæ, *Juss.* The Root. Indigenous.

The root of this plant, when fresh, has a sharp, penetrating taste, and a strong pungent odour. When chewed, it excites a sense of heat and a discharge of saliva. It contains an essential oil, on which its pungency depends. Its properties are destroyed by drying.

Medicinal Uses.—Horse-radish is a stimulant, diaphoretic, diuretic, expectorant, and sialogogue. Applied externally, it acts as a rubefacient. *Dose*, of the infusion, f ℥j. to f ℥iss.; of the spirit, f ℥j. to f. ℥ij.

Officinal Preparations. — Inf. Armoraciæ — Spir. Armoraciæ Comp. Seldom used.

ASSAFŒTIDA—FERULA ASSAFŒTIDA (Assafœtida). *Pentand.* Digyn. Umbellatæ, *Linn.*; Umbelliferæ, *Juss.* The Gum Resin. Persia.

This is a concrete juice, obtained from incisions made into the roots of the plant; the juice, after exuding, being inspissated by exposure to the sun. It generally occurs in masses of a variegated texture, being externally of a brownish-yellow colour, and containing many little shining tears of a whitish, reddish, or violet hue. The best is clear, of a pale-reddish colour, contains many white tears, and has a very strong odour. Assafœtida has a strong, very disagreeable alliaceous odour, with a subacrid, bitter taste. Its components, according to Tromsdorff, are, a volatile light oil, a heavy oil, a brown resin, and a bitter nauseous extractive.

Medicinal Uses.—Stimulant, expectorant, and antispasmodic; also emmenagogue. Its preparations have been given in amenorrhœa, hysteria, dyspnœa, and asthma. In the form of enema, it has been administered in tympanitis, flatulent colic, and hysteria. In this form it has also been used in cases of worms. *Dose*, gr. v.—3ij. in pill, or some of its compounds every three or four hours.

Officinal Preparations.—Mist. Assafœtidæ—Pil. Galban. Comp.—Spir. Ammon. Fœtid.—Tinct. Assafœtidæ.

AVENA—AVENA SATIVA (Common Oat).—Triand. Digyn. Graminese. The decorticated Seeds (grits.)

The oat was found by Anson growing wild upon the Island of Juan Fernandez, and on the coast of Chili; but its original locality is not known. The grain is highly nutritious and demulcent. Gruel, which is a decoction of the grains freed from the husk, is a most common diluent demulcent. In this form the oat is frequently prescribed in inflammatory diseases, dysentery, diarrhœa, &c. The meal boiled with water into a thick paste forms an excellent emollient poultice.

AURANTIUM—CITRUS AURANTIUM (Orange).—Polyadelph. Icosand. Pomaceæ, *Linn.*; Aurantiaceæ, *Juss. India.*

The orange tree is a native of India and Persia, but it is now abundantly propagated in Europe. The *juice* of the orange is a grateful acid liquor, with a slight degree of bitterness; it contains citric and malic acids, supercitrate of lime, albumen, mucilage, sugar, and water. The *outer rind* of the fruit has an aromatic flavour, with a warm bitterish taste, both of which depend upon an essential oil, which may be obtained by expression, but more abundantly by distillation. This part is dried for use. The *distilled water* of the *flowers* has a grateful perfume. An *oil distilled from* the flowers (*Oleum Neroli*) is also much valued as a perfume.

Medicinal Uses.—The juice of the fruit is a grateful refrigerant in febrile affections. The infusion and tincture of the rind form good tonics in dyspepsia and general debility. This infusion is a good menstruum for the exhibition of the disulphate of quina. *Dose*, of the infusion, f ʒj. to f ʒiss.

Officinal Preparations.—Inf. Aurant. Comp.—Inf. Gentian. Comp.—Confect. Aurantii—Tinct. Aurant.—Tinct. Cinchon. Comp.—Tinct. Gentian. Comp.

BALSAMUM PERUVIANUM—MYROSPERMUM PERUIFERUM (Peruvian Balsam).—Decand. Monogyn. Lomentaceæ, *Linn.*; Leguminosæ, *Juss.* South America.

This balsam is said to be extracted by boiling the bark and young branches of the tree with water: it is also obtained by putting the end of a billet of the wood into the fire, and thus forcing out the balsam at the opposite end. A balsam which exudes from incisions made early in the spring is collected in bottles, and is named *white liquid balsam;* when this condenses and hardens, it forms *dry white balsam*, or the BALSAM OF TOLU. Riuz says there is no difference in these three balsams, except in name, consistence, and colour.

Peruvian Balsam is thick and viscid, of a reddish-*brown* colour, has a fragrant smell, and a pungent *taste. It* is composed of resin, essential oil, benzoic

acid, extractive matter, water. It is entirely dissolved by alcohol.*

Balsam of Tolu, which is obtained as before described, is of a resinous appearance, a brown colour, and has a fragrant odour. It is perfectly soluble in alcohol, and imparts its taste and odour to water by decoction. It contains resin, benzoic acid, and volatile oil.

Medicinal Uses.—Stimulating expectorant, used in cases of catarrh and chronic bronchitis. It has also been prescribed in chronic rheumatism and in leucorrhœa.

The Tolu balsam is extremely mild, and is merely exhibited as a slight adjunct to the mucilaginous mixtures used in catarrh.

Officinal Preparations.—Syrupus Tolutan.—Tinct. Balsami Tolutan.—Tinct. Benzoin. Comp.

BARYTÆ CARBONAS.—This substance is merely used in the preparation of the Barii Chloridum. In geological language it is known by the name of *Witherite*.

BELLADONNA—ATROPA BELLADONNA (Deadly Nightshade).—Pentand. Monog. Solanaceæ, *Linn.*; Solaneæ, *Juss.* The Leaves. Indigenous.

This is an indigenous herb, which grows in shady situations, flowering in June, and ripening its berries in September. Its leaves, which are the officinal part, have scarcely any smell, and only a slight nauseous sub-acrid taste. The leaves contain vegetable albumen, chloride of potassium, sulphate, binoxalate, nitrate, and acetate of potash; and M. Brandes has detected in it a peculiar principle called *atropia*, which exists in the plant in the state of a *malate*. All parts of this plant are poisonous, and Buchner states that the root is the most active part of the plant; the seeds, however, yield the largest proportion of atropia.

* A *balsam* contains resin and benzoic acid; a turpentine, *resin and volatile oil.*

Atropia (C_{34}, H_{23}, NO_6 = 289).—The active principle of Belladonna is obtained from the root by the addition of spirit, hydrate of lime, distilled water, carbonate of potash, and dilute sulphuric acid. Atropia is extremely poisonous, opens in small white silky crystalline prisms, is inodorous, and possesses a nauseous, bitter, and somewhat acrid taste.

The *Sulphate of Atropia*, now first introduced into the Pharmacopœia, is prepared from the above, dilute sulphuric acid and water.

Medicinal Uses.—Atropia and its sulphate are only used externally for dilating the pupil. 1 gr. of the sulphate in ʒj. of water is a proper solution for this purpose.

Medicinal Uses.—Belladonna is powerfully narcotic, diaphoretic, and diuretic. It has been strongly recommended in pertussis, and as a preventive against the infection of scarlatina during epidemics of that disorder. It has also been employed in cases of ulceration, paralysis, mania, hydrophobia, and epilepsy. The extract is employed as an external application round the eye in cases of iritis, to cause dilatation of the pupil, and prevent adhesion. It is supposed to act by paralysing the circular fibres of the iris, but it is more probable that it acts on the retina, and that the dilatation of the pupil is a secondary result. With the intention of enlarging the pupillary aperture, it has also been used, both before and after the operation for cataract. Passed up the urethra on the point of a bougie, the extract has been found efficacious in cases of spasmodic stricture. In parturition, rendered lingering by rigidity of the os uteri, Chaussier recommends the application of this extract to the part. It is also used as an external application in neuralgia, palpitation of the heart from nervous debility, &c. Belladonna has been recently recommended to repress the secretion of milk. Dose, of the extract, gr. ¼th, cautiously increased to gr. ij.

Officinal Preparations.—Extractum Belladonnæ—Empl. Belladonnæ—Tinct. Belladonnæ—Unguentum Belladonnæ.

BENZOIN—STYRAX BENZOIN (Benzoin).—Decand. Monog. Bicornes, *Linn.*; Symplocæ, *Juss.* Sumatra.

Benzoin is obtained from the above tree, by making incisions into the bark near the origin of the lower branches. It is in brittle masses, the best being of a yellowish-brown colour, studded with white spots; the worst is blackish, and full of impurities. A tree yields about three pounds of balsam annually. It contains 80 of resin and 20 of benzoic acid in 100 parts.

Medicinal Uses.—The same as the other balsams. *Dose*, gr. v. to gr. xv.

Officinal Preparations.—Acidum Benzoicum.—Tinct. Benzoin. Comp.—Tinct. Camphor. Comp.

BERGAMII OLEUM—CITRIS LIMETTA BERGAMIUM. Asia.

The rind of the fruit of this species of citrus yields, either by pressure or distillation, a volatile oil of a pleasant odour. It is of a light-yellow colour, and has a warm aromatic taste.

Medicinal Uses.—It is not administered internally, but is merely used to give a pleasant odour to ointments.

Officinal Preparations.—Ung. Sulphuris.—Ung. Sulph. Comp,

BISMUTHUM—BISMUTH is generally found in the metallic state, sometimes as a sulphuret, but very rarely as an oxide. It is procured in Saxony and Bohemia, and in small quantities in Cornwall. It is used in the preparation of the *Bismuthi Trisnitras.*

BORAX—The BIBORATE OF SODA is obtained from an impure salt, named *Tincal*, which is imported from Persia and Thibet. This substance is found native near the margins of lakes. It is purified in Europe by crystallization, and is usually in masses of no regular *figure; its taste is cool;* it is soluble in eighteen parts

of cold and six of hot water. This salt is composed of two atoms of boracic acid, one atom of soda, and ten equivalents of water.

Medicinal Uses.—It is employed, in the form of the *mel boracis*, as a detergent in aphthous affections. Sometimes given internally in cases of inaction of the liver, and amenorrhœa.

Officinal Preparation.—Mel Boracis.

CAJUPUTI—MELALEUCA MINOR.—Polyadelph. Polyand. Hesperidiæ, *Lind.*; Myrtaceæ, *Juss.* Moluccа Islands.

Cajeput Oil is obtained by distillation from the leaves of this tree. It has a green or yellowish colour, a fragrant odour, resembling that of camphor, and a pungent taste. It is very volatile and inflammable. It is sometimes adulterated with oil of turpentine, which may be detected by the insolubility of the latter in alcohol. Its green colour has been attributed to the presence of copper; none, however, can be detected in it.

Medicinal Uses.—It has been employed as a diffusible stimulant and antispasmodic in hysteria, paralysis, cholera, flatulent colic, and other spasmodic and nervous affections. Diluted with olive oil, it has been used externally as an embrocation in cases of chronic rheumatism. It has been used in toothache. *Dose*, ♏ iij. to ♏v. on a lump of sugar.

CALUMBA—COCCULUS PALMATUS (Calumba).—Dioecia Dodecand. Menispermeæ, *Juss.* Africa.

Calumba is in round thin pieces, formed by transverse sections of the root; the circumference of these is covered with a bark; the woody part is of a light-yellow colour, spongy texture, and often worm-eaten. It yields its bitterness to water, and has been supposed to contain *cinchonia*. Dr. Duncan supposes its active *matter* is more allied to *picrotoxia*. This principle *is now termed Colombina*. Calumba has been adulterated with the roots of the bryony, the Frasera

Walteri, and the Costus Indicus. True calumba is distinguished by its producing a bluish-black colour with tincture of iodine, and not yielding a precipitate with the protosalts of iron.

Medicinal Uses.—Tonic and antiseptic, given in affections of the stomach and intestines, attended with excessive bilious secretion. It is also useful as a mild and grateful tonic in dyspepsia. It has been recommended to allay the nausea and vomiting which accompany pregnancy. As circumstances require, it may be combined with tonics, aromatics, anodynes, or salines. *Dose*, of the powder, gr. x. to gr. xx.; of the infusion, f ʒj. to f ʒiss. three times a day.

Officinal Preparations. — Tinct. Calumb. — Inf. Calumb.

CAMBOGIA — STALAGMITIS GAMBOGIOIDES (Gamboge).—Polygam. Moncec. Guttiferæ. *Jam.* India.

This *gum-resin* is obtained by breaking off the leaves and young shoots of the plant, from which the juice exudes, and gradually becomes inspissated. When it is of a proper consistence it is rolled into cylinders, and covered with leaves. It is brittle, inflammable, of a yellow colour, and a resinous fracture; has a bitter and acrid taste. It is partially soluble both in water and alcohol; the alkalies also dissolve it. According to Braconnot, it contains four parts of resin and one of gum.

Medicinal Uses.—Hydragogue and drastic cathartic. It is also an anthelmintic. It has been employed in obstinate constipation, combined with aloes; and in dropsies, in conjunction with bitartrate of potash. It has been given to destroy tænia. It occasionally produces vomiting and griping.* *Dose*, gr. iij. to gr. vj.

Officinal Preparation.—Pil. Cambog. Comp.

CAMPHORA—LAURUS CAMPHORA (Camphor).—En-

* Gamboge does not *irritate* the rectum; and seems to act *chiefly on the small intestines.*

neand. Monogyn. Oleraceæ, *Linn.;* Laurineæ, *Juss.* Asia.

Camphor is a peculiar vegetable principle, which is contained in many plants, particularly those of an aromatic kind, diffused through their wood or bark, and is often deposited from their essential oils when these are long kept. It is found in large quantity in the Dryobalanops Camphora, the root of the Laurus Cinnamomum, and in the oils of most of the Labiatæ. It is obtained from the roots and branches of the Laurus Camphora by distillation; and is also found in large masses in the centre of this tree.

Camphor is colourless and semi-transparent; its odour is strong and fragrant; its taste pungent and bitter; sp. gr. 0·988. It is volatile at ordinary temperatures; it melts at 288°, and boils at 400°; it is highly inflammable; is very sparingly soluble in water, one fluid ounce dissolving little more than half a grain; but is soluble in alcohol, ether, and oils, essential or expressed. Its solubility in water is increased by the addition of carbonic acid or magnesia. Nitric acid converts camphor into a peculiar acid called *camphoric.* Camphor is considered to be an oxide of Camphogen (C_{10} H_8), or a solid volatile oil composed of C_{10} H_8 O.

Artificial Camphor may be obtained by passing hydrochloric acid gas through oil of turpentine.

Medicinal Uses.—It is stimulant, narcotic, antispasmodic, and diaphoretic. As a stimulant, it has been used in cases of typhus, cynanche maligna, retrocedent gout, confluent small-pox, mercurial erethism, and *gangrena senilis.* In hysteria, epilepsy, chorea, asthma, spasm of the neck of the bladder, and painful menstruation, it has been used as an antispasmodic. Camphor has also been recommended in cases of pneumonia, acute rheumatism, mania, gout, delirium tremens, *gonorrhœa,* and where there is irritation of the urinary *organs* arising from the action of cantharides. Exter-

nally applied, camphor is used as an anodyne in rheumatism and muscular pains, and as a discutient in chronic inflammatory affections. It is dissolved in alcohol or oil, and applied by friction to the part. In large doses it acts as a narcotic poison. Emetics and stimulants are the remedies. *Dose*, gr. v. to gr. x.

Officinal Preparations.— Mist. Camp.—Tinct. Camph. —Lin. Camph.—Lin. Camph. Comp.—Lin. Hydrarg. Comp.—Lin. Saponis.—Lin. Terebinth.

CANELLA—CANELLA ALBA. (Canella).—Dodecand. Monogyn. Oleraceæ. *Linn.*; Meliaceæ: *De Cand.* West Indies.

The inner bark of the branches of this tree, which is the officinal part, is in quills, or flat pieces, of a light yellowish-grey colour; its flavour is somewhat aromatic, and its taste is pungent. By distillation it yields a thick essential oil. Canella bark is occasionally adulterated with that of the *wintera aromatica*, from which it is distinguished by its neither containing tannin nor oxide of iron. It yields a crystallizable saccharine substance incapable of fermentation, called canellin; it is probably mannite.

Medicinal Uses.—It is chiefly employed in consequence of its aromatic properties, to disguise the taste of other medicines.

Officinal Preparation.—Vin. Aloes.

CANTHARIS—CANTHARIS VESICATORIA (Spanish Fly). Cl. Insecta; Family, Trachelideæ; Tribe, Cantharideæ.

This insect is found adhering to the leaves of the ash, elder, privet, lilac, and other trees in Spain, Italy, and France. Cantharides are of a rich lively green and yellow colour, have a faint, unpleasant smell, and a slightly acrid taste. Robiquet obtained from cantharides a volatile oil and a white crystallizable matter, to which the active properties are owing; the latter he named *cantharidin*. The melolontha vitis, *an insect resembling* cantharides, is used to adulterate

them. It may be distinguished by its form being more square than cantharides, and by its black feet.

Medicinal Uses.—Stimulant and diuretic when exhibited internally; externally applied, it acts as a rubefacient and epispastic. They have been advantageously employed in ischuria, obstinate gleet, paralysis of the bladder, incontinence of urine from weakness of the sphincter vesicæ, amenorrhœa, leucorrhœa, and dropsies. The free use of demulcents, as milk, almond emulsion, and mucilaginous fluids, is absolutely requisite during the administration of cantharides. As an epispastic, cantharides, in the form of a blister, have long been reputed as a counter-irritant and derivative in chronic inflammations. Taken in large doses they act as a poison, producing violent straining, vomiting, and general irritation of the intestinal canal. *Dose*, of the powder, gr. ½ to gr. j. made into a pill, with opium or hyoscyamus; of the tincture, ♏ x. to ♏ xx.

Officinal Preparations.—Tinct. Canth.—Acet. Canth.—Cerat. Canth.—Empl. Canth.—Ung. Canth.

CAPSICUM—CAPSICUM ANNUUM (Capsicum, or Guinea Pepper).—Pentand. Monog. Solanaceæ, *Linn.*; Solaneæ, *Juss.* East and West Indies.

The fruit of this plant is an oblong pod, of an orange colour, containing a pulp enclosing seeds. The membraneous pod has an aromatic and penetrating odour, which is impaired by drying; its taste is hot and pungent. Its active matter is extracted by alcohol. According to Braconnot, capsicum contains *capsicine*, colouring matter, an azotized substance, gum, pectic acid, and saline matters.

Medicinal Uses.—Tonic and stimulant. It has been used in atonic gout, dyspepsia, intermittent fevers, and the later stages of fever, when the powers of the system are exhausted. An infusion of capsicum in *diluted vinegar*, with the addition of salt, has been *used as a gargle* in relaxed sore throat: the infusion

should be well strained. *Dose,* of the powder, gr. iij. to gr. x.

Officinal Preparation.—Tinct. Capsici.

CARDAMINE—CARDAM. PRATENSIS (Cuckoo Flower). —Tetradynam. Siliquosæ. Leguminosæ. Indigenous. This is a small annual plant, flowering early in the spring. The leaves have a bitterish taste, and are said to be antiscorbutic.

Medicinal Uses.—The flowers are said to be diuretic and antispasmodic, and are given in asthma and nervous affections. *Dose,* gr. x. to ʒss.

CARDAMOMUM—ALPINIA CARDAMOMUM—(Lesser Cardamom). Monand. Monogyn. Cannæ, *Juss.* India.

The seeds are dried, and imported in their capsules, by which the flavour is better preserved. Their smell is aromatic and taste pungent; by distillation they yield an essential oil.

Medicinal Uses.—Tonic and aromatic; used as adjuncts to bitters or purgatives. *Dose,* gr. v. to gr. x.

Officinal Preparations.—Tinct. Cardam.—Tinct. Cardam. Comp.—Tinct. Cinnam. Comp.—Tinct. Conii.—Tinct. Gentian. Comp.—Tinct. Sennæ Comp. —Confect. Aromat.—Decoct. Aloes Comp.—Extract. Colocynth. Comp.—Pulv. Cinnam. Comp.

CARUI—CARUM CARUI (Carraway).—Pent. Digyn. Umbellatæ, *Linn.;* Umbelliferæ, *Juss.* South of Europe.

Carraway seeds are chiefly imported from Germany, but are also cultivated in large quantities in this country. The second year's seeds are the best. They have an aromatic flavour and a warm taste, depending chiefly on an essential oil, of which they contain a considerable quantity.

Medicinal Uses.—Stomachic and carminative, used to relieve flatulence; their essential oil is frequently *added to other medicines* to prevent nausea or griping.

Officinal Preparations.—Aqua Carui—Ol. Carui—Spir. Carui—Spir. Juniper. Comp.—Conf. Opii—Conf. Rutæ—Tinct. Sennæ Comp.—Pil. Aloes Comp.—Pil. Rhei Comp.

CARYOPHYLLUS — CARYOPHYLLUS AROMATICUS (Cloves).—Icosand. Monogyn. Hesperideæ, *Linn.*; Myrtaceæ, *Juss.* Moluccas.

The cloves are the flower-buds, which are first dried by means of the smoke from fuel, and then by exposure to the sun. They are of a greyish-brown colour, have a strong aromatic odour, and a warm taste. The best are large, heavy, brittle, and when pressed yield a little oil. Cloves contain volatile and fixed oils, astringent extractive matter, gum, resin, vegetable fibre, &c. &c.

Medicinal Uses.—Stimulant and aromatic, employed principally as adjuvants to other medicines, particularly combined with bitters, or the vegetable cathartics. The *oil* is used as a corrigent to griping extracts, and sometimes as a local application in toothache. *Dose*, of the powder, gr. v. to gr. x.; of the oil, mij. to mv.

Officinal Preparations.—Inf. Caryoph.—Ol. Caryoph.—Conf. Aromat.—Conf. Scammon.—Inf. Aurant. Comp.—Spir. Ammon. Aromat.—Vin. Opii.

CASCARILLA—CROTON CASCARILLA (Cascarilla).—Monæc. Monand. Euphorbiaceæ, *Juss.* Bahama Islands, North America.

Cascarilla bark is in quills of a grey colour, has a slightly aromatic smell, and a warm bitter taste. It is very inflammable, and when burnt produces an agreeable odour. It contains volatile oil, bitter resin, gum, extractive matter, traces of chloride of potassium, and lignin.

Medicinal Uses.—Tonic and aromatic, and as such has been recommended as a substitute for the Peruvian bark in intermittents. It is, however, a very *inefficient* one. As a *light* tonic it is sometimes given

in consumption. It has been employed as a remedy in obstinate diarrhœa and dysentery. *Dose*, of the powder, gr. x. to gr. xx.; of the infusion, f ℥iss.; of the tincture, f ℥j. to f ℥iij.

Officinal Preparations.—Inf. Cascarillæ—Tinct. Cascarillæ—Mist. Cascarillæ Comp.

CASSIA—CASSIA FISTULA (Purging Cassia).—Decand. Monog. Lomentaceæ, *Linn.*; Leguminosæ, *Juss.* Egypt, East and West Indies.

The fruit of this tree is in cylindrical pods, nearly an inch in diameter, and ten or twelve inches in length. The external membraneous part is firm and hard; it is divided within by septa, between which the seeds are contained, in a soft pulp. According to Vauquelin's analysis of it, it consists of sugar, gum, tannin, and gluten.

Medicinal Uses.—Mildly laxative; seldom used, except for children. In a large dose, sufficient to purge, it is apt to induce nausea and griping. *Dose*, for a child, ℥j. to ℥iij.; for an adult, ℥ss. to ℥vj.

Officinal Preparations.—Conf. Cassiæ—Conf. Sennæ.

CASTOREUM—CASTOR FIBER (Castor).—Mammalia. Glires.

Castor is a peculiar substance found in membraneous cells, which exist between the anus and external genitals of the common beaver. The follicles containing it are cut off and dried by exposure to the smoke of fuel. The best castor is imported from Russia, but the largest quantity is brought from Canada. The active matter of castor has been named *Castorine*, and is soluble in alcohol, proof spirit, and partially in water.

Medicinal Uses.—Stimulant and antispasmodic, given in hysteria and amenorrhœa. *Dose*, of the substance, gr. x. to gr. xx.; of the tincture, f ℥j. to f ℥ij.

Officinal Preparation.—Tinct. Castorei.

CATECHU—ACACIA CATECHU (Catechu).—Polygam.

Monœc. Lomentaceæ, *Linn.*; Leguminosæ. *Juss.* India.

Catechu is obtained by cutting the inner wood into chips, boiling them in water, and evaporating the decoction. The extract thus obtained is inspissated by exposure to the heat of the sun, and after some time becomes concrete and dry. It is met with in three forms; either in large, irregular masses, in squares of rather more than an inch in diameter, or in flattened rounded cakes. Catechu, when pure, is entirely soluble in water, with the aid of heat; it is also very readily dissolved in alcohol. It contains tannin (or a modification of it, called *catechinen*), extractive matter, mucilage, and traces of gallic acid.

Medicinal Uses.—Astringent, given with much advantage in cases of diarrhœa, chronic dysentery, and some forms of hæmorrhage. Its infusion has been used as a gargle in relaxation of the uvula. *Dose*, of the powder, gr. x. to ℈j.; of the tincture, f℥j. to f℥iij.; of the infusion, f ℥j. to f ℥iss.

CENTAURIUM—ERYTHRÆA CENTAURIUM (Centaury).—Pentand. Monogyn. Rotaceæ, *Linn.*; Gentianeæ, *Juss.* Indigenous.

The whole of this small herbaceous annual plant, except the root, is officinal.

Medicinal Uses.—Tonic, given in the same cases as gentian.—*Dose*, from ℈j. to ℥j.

CERA FLAVA AND ALBA.—*Wax* is a concrete substance, supposed to be collected by the bee from the antheræ of vegetables. The experiments of Huber prove that it can be formed by the bee from changes produced on its saccharine food.* When merely melted from the honeycomb, it retains a portion of colouring matter, and constitutes *yellow wax*. This substance being melted and cast into thin cakes, which are exposed to the joint action of light, air, and humi-

* *See the observation at p. 183, on the formation of fat from sugar or starch, by abstracting its oxygen.*

dity, becomes bleached, and then forms what is called *white wax*. Wax resembles the fixed oils in its chemical properties, but differs from them in its solidity, and in not readily combining with the alkalies.

Medicinal Uses.—It is chiefly used as an ingredient to give tenacity to cerates and ointments. It has, however, been recommended as a demulcent in dysentery. *Dose*, from ʒss. to ʒiss.

CEREVISIÆ FERMENTUM.—*Yeast* is the frothy scum which collects on the surface of beer while fermenting.

Its fermentive principle is vegetable gluten in a state of decomposition, vide p. 195. It soon undergoes the putrefactive fermentation when kept in a liquid state, but may be preserved for some time by drying it. It is chiefly used to excite the vinous fermentation in saccharine matter, and the panary in farinaceous substances.

Medicinal Uses.—Yeast is tonic and antiseptic, and has been given in typhoid fevers. It is most used as a stimulating application, or poultice, to sluggish or gangrenous sores. It promotes the formation of healthy pus, accelerates the sloughing, and corrects any fœtor of the discharge. *Dose*, fʒss.

Officinal Preparation.—Cataplasma Fermenti.

CETACEUM—PHYSETER MACROCEPHALUS.—Mammalia. Cetaceæ.

Spermaceti is the fatty matter obtained from the cranium of this species of whale. When the oily matter found in the head of the whale is allowed to stand, this substance is deposited. This is to be pressed, and boiled with a weak solution of an alkali, in order to remove any adhering oil. It exists in flaky masses; it is unctuous and friable, and has neither taste nor smell.

Medicinal Uses.—Demulcent; given in cases of catarrh and gonorrhœa, mixed with sugar, or diffused in water by means of the yolk of an egg. It enters *into the composition of* some ointments.

Officinal Preparations.—Cerat. Cetacei—Ung. Cetacei.

CETRARIA—CETRARIA ISLANDICA (Iceland Liverwort).—Cryptogam. Algæ. Iceland.

The different lichens (including the carrageen, which is often used) contain a large proportion of starch, and this is easily extracted from them.

This lichen contains some extractive matter, which is bitter. The bitterness may be removed by maceration in cold water, which dissolves the extractive matter, and then, on boiling with water, a gelatinous solution is obtained.

Medicinal Uses.—Nutrient and demulcent; recommended in cases of hæmoptysis and phthisis. It may be taken *ad libitum*, in the form of decoction.

Officinal Preparations.—Decoct. Cetrariæ.

CHIMAPHILA — CHIMAPHILA CORYMBOSA (Winter Green).—Decand. Monogyn. Ericineæ, *Juss.* India, North America.

The leaves and stems of this plant are the parts commonly used. The leaves have a sweet taste, with some bitterness; the stalks are astringent.

Medicinal Uses.—The decoction, when administered warm, acts as a diaphoretic; when used cold, its action is diuretic. It has been given in cases of dropsy, and in nephritic affections. *Dose*, from half a pint to a pint of the decoction may be given within twenty-four hours.

Officinal Preparations.—Decoct. Chimaphilæ.

CINCHONA CORDIFOLIA—CINCHONA LANCIFOLIA—CINCHONA OBLONGIFOLIA—CINCHONA (Peruvian Bark).—Pentand. Monogyn. Contortæ, *Linn.*; Rubiaceæ, *Juss.* Peru.

The bark of each of these varieties is the officinal portion. That from the first species is named *yellow bark;* that from the second, *quilled*, or *pale bark;* and *from the* third, *red bark*. The bark is stripped from *the trunk* and branches during the dry season, and is

dried by exposure to the sun. After being imported into Europe, it is sorted, by separating the finer from the coarser.

The *yellow* bark is in flat pieces, not convoluted, like the pale, nor dark-coloured, like the red; it is externally smooth, internally of a light cinnamon colour; it has no peculiar odour different from the others, but a taste much more bitter, with scarcely any sensible astringency. The best *pale* bark is in thin pieces, singly convoluted, forming small quilled twigs, internally, of a cinnamon colour, smooth, but fibrous in texture; externally, it is covered with a thin epidermis, of a greyish brown colour, to which a coat of lichen sometimes adheres. Its powder is of a pale colour. The *red* bark is in large thick pieces, usually flat, though occasionally quilled; externally, covered with a brown, rugged epidermis; internally, more smooth and compact, but fibrous, the fibres being coarse and of a dark-red colour.

The medicinal virtues of the barks reside in two distinct proximate principles, *quina* and *cinchonia*, which exist in various proportions in the different barks. In the cinchona lancifolia, cinchonia is present in considerable quantity, but there is very little quina; the cinchona cordifolia, on the other hand, contains a very large proportion of quina, and but very little cinchonia; while the cinchona oblongifolia contains both principles in considerable proportion.

The quina and cinchonia are in combination with *cinchonic acid*. The barks also contain green fatty matter, a red and yellow colouring matter, tannin, starch, ligneous fibre, cinchonate of lime, &c.

The process for obtaining quina, which has been detailed in the pharmaceutical section of this work, equally applies to cinchonia. Cinchonia differs from quina in being crystallizable and less bitter.

The chemical constituents of the cinchona barks are—1. *Alkaloids*—quina, cinchonia, quinidia, and

aracina. 2. Acids—konic, sulphuric, a variety of tannic acid called cincho-tannic, an acid called cinchofulvic, or red cinchonic and kinovic acid. 3. Fatty matter, some volatile oil, and salts of lime, along with resin, starch, gum, and woody fibre.

Medicinal Uses.—Cinchona bark is a powerful and permanent tonic, possessing also antispasmodic and antiseptic powers. Its efficacy is most remarkable in those diseases which have a tendency to attack periodically. It has been given in intermittent, remittent, and typhoid fevers, with marked advantage; but it is in the first form of fevers it shows its peculiarly powerful action in so evident a degree. It has also been employed in cases of rheumatism, erysipelas, gangrene, scrofulous, and venereal ulceration, dyspepsia, neuralgia, and in a variety of spasmodic affections. It is also useful in cases of passive hæmorrhage and protracted debility. It is usually combined with sulphuric acid as an astringent, with the preparations of iron as a tonic, with those of mercury in syphiloid diseases, with valerian in spasmodic affections, and with conium in scrofulous and other ulcerations. *Dose*, of the powdered cinchona, ℥ss. to ℥iij.; of the infusion or decoction, f℥j. to ℥iss.; of the tinctures, f℥j. to f℥iij.; of the extracts, gr. x. to gr. xv.

The relative strength of powdered bark and the disulphate of quina has been variously stated, some authors computing it as one grain of the alkaloid to one drachm of the bark; and others, as one grain to two scruples. The latter is the opinion received at the Apothecaries' Hall.

Officinal Preparations.—Quinæ Disulph.—Decoct. Cinchonæ Cordifol., Lancifol., et Oblongifol.—Extracta Cinchon. Cordifol., Lancifol., et Oblongifol.—Inf. Cinch. Lancifol.—Tinct. Cinchon.—Tinct. Cinchon. Comp.

CINNAMOMUM—LAURUS CINNAMOMUM (Cinnamon).

—Enneand. Monogyn. Oleraceæ, *Linn.*; Laurineæ, *Juss.* Ceylon.

The cinnamon is the internal bark of the branches of the tree; it is thin and convoluted, friable, of a light brown colour, agreeable pungent taste, and an aromatic flavour. Its properties depend upon a highly odorous and pungent essential oil, which it contains, and which may be obtained from it by distillation.

Medicinal Uses.—Tonic and aromatic, used to cover the unpleasant flavour of other medicines. Under the form of tincture or distilled water it is useful in relieving nausea.

Officinal Preparations.—Conf. Aromat—Inf. Catechu Comp. — Pulv. Cinnam. Comp. — Pulv. Cretæ Comp.—Pulv. Kino Comp.—Spir. Ammon. Aromat. —Spir. Cinnam.—Tinct. Cinnam. Comp.—Tinct. Catechu.—Tinct. Lavand. Comp.—Vin. Opii.—Mist. Spiritus. Vini Gallici.

Cocci—Coccus Cacti (Cochineal Insect).—Insecta, Hemiptera. Mexico; West India Islands.

This insect feeds and propagates upon a species of cactus. The female insects, which alone are used, are detached from the plants by a blunt knife, and killed either by dipping them in boiling water, or by applying heat to them in a stove. There are two varieties of cochineal in the shops, the one known as the *silver grain*, and the other as the *black grain*; the former is the best. According to the analysis of Pelletier and Caventou, cochineal contains carmine (*cochinaline*), phosphate and carbonate of lime, chloride of potassium, phosphate of potass, and potass united to an animal acid.

Medicinal Uses.—In pharmacy, as a colouring matter.

Officinal Preparations.—Tinct. Card. Comp.—Tinct. Cinch. Comp.

Colchicum—Colchicum Autumnale (Meadow Saffron).—Hexand. Trigyn. Liliaceæ, *Linn.*; Colchicaceæ, *De Cand.* Indigenous.

The parts of this plant which possess active properties are, the flowers, the seeds, and the corm; the two latter are officinal. The history of this plant is curious. The *cormus*—that is to say, the swollen base of the plant, improperly called *bulb*—sends up in the autumn a delicate purple flower, quite naked, and free from leaves. This flower soon perishes, and the seed vessel beneath it remains under ground all the winter; but makes its appearance with the leaves early in the spring. When the seed is ripe, the cormus from which it proceeded is exhausted and forms a second cormus, which goes through the same process of sending up a flower in the autumn. The time, therefore, to dig up the cormus is about the end of July, when it is fully formed, but before it has sent up the flower. When the cormus is good, it should strike a blue colour on rubbing it with a little distilled vinegar and tincture of guaiacum. The transverse section of colchicum should not present a depression in two parts of its circumference, as that indicates its being a second year's cormus, which is not so active as a medicine. In the seeds of colchicum the *colchicia* exists in the testa or husk, and consequently the seeds should not be bruised in preparing the wine or tincture. The constituents of colchicum, according to Pelletier, are, veratria (*colchicia*), combined with gallic acid, fatty matter, yellow-colouring matter, gum, starch, inulin in large quantity, and lignin.

Medicinal Uses.—Drastic, cathartic, diuretic, sedative, anodyne and occasionally diaphoretic. This medicine has long been regarded as having a specific action in gout and rheumatism, but more especially in the former. It is a point on which there is much variance of opinion, whether the efficacy of colchicum depends upon its cathartic and diuretic action, or upon a specific influence, independent of these more sensible effects. Colchicum causes a considerable influx of bile into the intestines, and also increases the secretion of

the succus intestinalis. It is generally combined with magnesia in cases of gout. Of late, the preparations of colchicum have been strongly commended in several inflammatory affections, as encephalitis, meningitis, &c. When given in too large doses, colchicum produces nausea, vomiting, and hypercatharsis, with traces of blood in the evacuations. *Dose*, of the powdered cormus, gr. iij. to gr. v.; of the wine ℥xx. to ʒss.; of the ammoniated spirit, ʒss.; of the vinegar, ʒj. to ʒij.; of the acetous extract, gr. iij.

Officinal Preparations.—Extract. Colchici.—Extract. Colch. Aceticum.—Tinct. Colchici.—Tinct. Colch. Comp.—Vinum Colchici.

COLOCYNTHIS—CUCUMIS COLOCYNTHIS (Colocynth).—Moncœc. Syngenes. Cucurbitaceæ, *Linn.; Juss.* Syria.

The dried pulp of the *pepones*, or gourds, is the part of the colocynth used in medicine. It is white, soft, and porous; its taste is intensely bitter; and when boiled with water, it yields a liquor of a gelatinous consistence. On evaporating an alcoholic solution of colocynth, a golden yellow substance is obtained, which Vauquelin named *colocyntine*, and which he regards as the active principle of the plant.

Medicinal Uses.—Drastic cathartic, used generally to accelerate the action of other cathartics, as in combination with aloes, scammony, or calomel. A little of some aromatic oil, or extract of henbane, assists the purgative effect and hinders it from griping. Colocynth enema is useful as a derivative and anthelmintic. *Dose*, of the powder, gr. ij. to gr. v.; of the compound extract, gr. v. to gr. x.

Officinal Preparations.—Extract. Colocynth.—Pilula Colocynth. Comp.—Enema Colocynth.

CONII FOLIA—CONIUM MACULATUM (Spotted Hemlock).—Pentand. Digyn. Umbelliferæ, *Linn.*, *Juss.* Indigenous.

This plant is characterized by its large and spotted

stalk, by the dark green colour of the lower leaves, and by its peculiarly faint and disagreeable odour. The leaves and fruit are officinal. It contains resin, extractive gum, albumen, a green fecula, an odorous oil, a peculiar alkaline principle (*conia*), and various saline substances, and gives a peculiar odour when rubbed with potass. Orfila found the extract prepared by boiling the dried powder in water, and evaporating, to be perfectly inert, the active matter being insoluble in water.

Medicinal Uses.—Narcotic and anodyne; it appears to act by diminishing nervous irritability, and allaying morbid sensations. It has been recommended in cases of asthma, bronchitis, pertussis, and phthisis; also in scirrhus, scrofulous ulcerations, secondary syphilis, &c. The compound hemlock pill of the present Pharmacopœia is an excellent medicine in acute pertussis. Its administration should be attended with much caution, for even in moderate doses it is liable to produce sickness and vertigo, and in larger doses it occasions permanent sickness, dimness of vision, delirium, convulsions, and coma. Although this medicine must be given at first with moderation, there is no narcotic in the list of officinal drugs which requires to be more rapidly increased in dose, and it may eventually be taken in considerable quantity. *Dose*, of the powder, gr. ij. to gr. xv.; of the extract, gr. ij. to gr. x.

Officinal Preparations.—Cataplasma Conii—Extract. Conii—Pil. Conii. Comp.—Tinct. Conii.—Unguent. Conii.

COPAIBA—COPAIFERA LANGSDORFII (Copaiba).—Decand. Monogyn. Amyridaceæ, *De Cand.* South America.

The copaiba is obtained by wounding or boring the *trunk* of the tree, when it flows abundantly in the *form of a clear*, colourless liquid, which is thin at first, *but becomes* thick and tenacious, and acquires a yel-

lowish colour by age. Genuine copaiba has a peculiar, but not disagreeable smell, and a pungent bitter taste. It is a turpentine balsam. It is insoluble in water, but is completely soluble in alcohol and ether. Distilled with water, it affords nearly half its weight of an essential oil, an insipid resin being the residuum. *Vide* note, p. 314.

It is sometimes adulterated with mastich and oil, and occasionally with rape oil and castor oil. According to Bucholz, if copaiba does not dissolve completely in a mixture of four parts of alcohol and one of rectified sulphuric ether, its adulteration may be inferred. The adulteration with castor oil is discovered by mixing three parts of the suspected balsam with one part of sulphuric acid; if it be pure, a plastic, reddish mass will be formed; if it contain castor oil, its consistence will be that of turpentine, and the colouring will be very slight. If copaiba does not rapidly solidify on being mixed with calcined magnesia, it contains some fixed oil.

Medicinal Uses. — Stimulant, diuretic, and occasionally it acts as a brisk purge. From its power of stimulating the urinary passages, it has been much used in sub-acute gonorrhœa and in gleet. It is also strongly recommended by Sir A. Cooper in catarrhus vesicæ. Copaiba is found efficacious in chronic affections of the mucous membranes generally, as in chronic catarrh, sub-acute bronchitis, and chronic dysentery. It is also useful in leucorrhœa, and in that state of the uterus which occurs occasionally on the cessation of the menses, in which there is a sanious discharge, bearing down, and many symptoms of incipient cancer. Copaiba has been recommended in cases of hæmorrhoids. In too large doses it acts so powerfully on the kidney that it is liable to produce inflammation of that organ. It is also liable to produce fever with an exanthematous rash. *In consequence* of copaiba being so liable to

produce nausea, various methods for its administration have been devised ; such as dropping it on a piece of sugar, taking it either in a glass of pure, or in some aromatic, water, or, in the form of emulsion, with gum or yolk of egg. It is given also enclosed in small gummy capsules by which its taste is totally concealed. A very common form of administering it is in combination with spirit of nitric ether. *Dose*, ɱx. to ɱxxx. twice or three times a day.

CORIANDRUM—CORIANDRUM SATIVUM (Coriander). — Pentand. Digyn. Umbellatæ, *Linn.* ; Umbelliferæ, *Juss.* South of Europe.

The fruit, which is officinal, consists of two concave hemispherical seeds. The seeds have an aromatic smell and taste, depending on a volatile oil, which can be separated by distillation.

Medicinal Uses.—Carminative and aromatic, used as an adjunct to other medicines. *Dose*, gr. xx. to gr. xxx.

Officinal Preparation.—Confect. Sennæ.

CORNU—CERVUS ELAPHUS (The Stag, or Hart).—DIV. Vertebrata ; Cl. Mammalia ; Ord. Ruminantia, *Cuvier.*

The horns of the deer are similar to bone in composition, containing a considerable quantity of gelatine, with a phosphate or carbonate of lime. They are freed from their outer rough covering, and the internal white part is rasped. By destructive distillation, these raspings yield an impure solution of carbonate of ammonia, named *spirit of hartshorn.* When burnt, the residue is chiefly phosphate of lime. By decoction in water, a transparent, colourless, and inodorous jelly is obtained.

Medicinal Uses.—The jelly, which is obtained by *decoction*, when rendered grateful with sugar and a *little wine, is* used in diarrhœa and dysentery as a *demulcent.* The principal use of this substance is, in

pharmacy, in making the pulvis antimonii compositus.

Officinal Preparation.—Pulv. Antim. Comp.

CREASOTON (C_{12}, $H_8O_2 = 96$).—Creasote is generally obtained from the impure pyroligneous liquid which is evolved by the destructive distillation of wood. In this liquid, besides creasote, five other principles bearing some relation to it are found. These are—paraffine, eupione, pittacal, picamar, and capnomor. The heaviest tarry liquid is treated with carbonate of potash and distilled. The oily liquid is then mixed with a strong solution of potash, which, combining with the creasote, allows the eupione to collect on the surface, and decomposes the other organic matters. The potash is next to be removed by sulphuric acid, and the creasote is obtained by distillation. In order to purify it, the above process must be repeated several times.

When pure, creasote is a colourless liquid, of a thin, oily consistence, possessing a strong odour and a pungent taste. Its sp. gr. is 1·066. It boils at 397°F. It is very soluble in alcohol, ether, naphtha, and acetic acid; has no acid nor alkaline reaction, but combines with both acids and alkalies. It forms compounds with soda, potash, and lime, which are soluble in water, but which are decomposed by weak acids.

Medicinal Uses.—Creasote has been given in cases of hæmoptysis, diabetes, and persistent vomiting, which it occasionally checks when all other remedies fail; in gangrene, lumbago, rheumatism, foul ulcers, &c. It is a powerful remedy in toothache, which in some instances, it checks immediately; but it should be solely applied to the hollow of the tooth, not to the gums or cheek, which it excoriates. It may be given in the liquid form, or in pills. *Dose*, ♏j. to ♏v.

CROCI STIGMATA—CROCUS SATIVUS (Saffron).—Triand. Monogyn. Liliaceæ, *Linn.*; Irideæ, *Juss.* Indigenous.

The stigmata which crown the pistil of the flower are separated from the other parts, submitted to pressure with a moderate heat, and thus form a mass of intermixed fibres named *cake-saffron;* when dried separately, they form *flower-saffron.* Cake-saffron is in tough cakes, somewhat moist, and of a deep reddish-yellow colour; its flavour is aromatic and diffusive, and its taste warm and bitterish. An extract of a deep yellow colour, named *polychroite,* is obtained from saffron; it constitutes half the weight of this substance. Saffron is occasionally adulterated with smoked beef, the petals of the saff-flower (*Carthamus tinctorius*), and of officinal marigold (*Calendula officinalis*). These are easily detected by infusing the suspected saffron in warm water, when the expanded stigmas will be easily distinguished.

Medicinal Uses.—Saffron was formerly regarded as a stimulant and antispasmodic, but experience has proved it to be nearly inert. It is now merely used to colour other medicines.

Officinal Preparations.—Confect. Aromat.—Decoct. Aloes Comp.—Pil. Aloe cum Myrrh.—Syrup. Croc. —Tinct. Aloes Comp.—Tinct. Cinchon. Comp.—Tinct. Rhei Comp.

CUPRI SULPHAS ($CuO,SO_3 + 5Aq. = 125$). — SULPHATE OF COPPER, or Blue Vitriol, is obtained by evaporation from the water which filtrates through copper mines, in which it exists dissolved; or it is prepared by calcining the native sulphuret of copper, and exposing it in a moist state to the atmosphere. The copper becomes oxidised; the sulphur, also, attracting oxygen, is converted into sulphuric acid, and the sulphate of copper thus formed is procured by lixiviation and crystallization. It may also be obtained by adding diluted sulphuric acid to copper.

Sulphate of copper is inodorous, and has a very *harsh, acrid, styptic* taste. It is in semitransparent

crystals, which undergo a slight degree of efflorescence when exposed to a dry atmosphere: their form is rhomboidal, and their colour a deep rich blue.

Medicinal Uses.—Tonic, astringent, and emetic; externally, astringent, and escharotic. Given internally, in small doses, it is found serviceable in cases of chronic dysentery, diarrhœa, passive alvine hæmorrhages, intermittent fever, epilepsy, and phthisis. It has lately been much used on the Continent in cases of croup, in which disease it seems to produce marked benefit. It should first be given so as to excite vomiting, and then be administered in small and repeated doses afterwards. As an emetic, it has been given in cases of narcotic poisoning. Externally, it has been used as a collyrium in cases of chronic ophthalmia, and as a stimulant lotion to sluggish sores. *Dose*, gr. ss. to gr. iij. as a tonic and astringent; as an emetic, gr. x. to gr. xv.

Officinal Preparation.—Cuprum Ammoniatum.

CURCUMA—CURCUMA LONGA (Turmeric).—Monand. Monogyn. Scitamineæ. East Indies.

The best turmeric is imported from Ceylon, in firm, short, wrinkled pieces, of an ash colour externally, and internally of a deep orange yellow. They should be heavy, and not worm-eaten. Paper stained by a solution of turmeric forms the best test for the alkalies.

Medicinal Uses.—Aromatic and stimulant; recommended in flatulent colic. It is chiefly used as an ingredient in curry powder, and to colour different substances. *Dose*, gr. x. to ʒss.

CUSPARIA—GALIPEA CUSPARIA (Angustura Bark).—Diand. Monogyn. Rubiaceæ. South America.

This bark is in flat pieces, externally grey and wrinkled, internally of a yellowish-brown colour, and smooth. Its taste is bitter, and slightly aromatic. It contains *resin, extractive matter*, carbonate of ammonia,

volatile oil, igasuric acid, probably combined with *cinchonia.*

False Angustura Bark (*Brucia antidysenterica*) was formerly much used to adulterate the true bark ; and as it is highly poisonous, fatal consequences frequently ensued. The true bark has a finer texture than the false, is darker coloured, and less bitter. By adding ferrocyanide of potassium to a hydrochloric infusion of the false bark, a precipitate is obtained, which is at first greenish, and then becomes blue. The same reagent changes into blue the reddish powder which lines the bark. The true bark is not affected by this test, as it does not, like the false, contain oxide of iron.

Medicinal Uses.—It is a stimulating tonic; used with advantage in cases of obstinate diarrhœa, dysentery, and dyspepsia. It was formerly employed in intermittents as a substitute for cinchona, but it failed in most cases. *Dose,* of the powder, from ten to twenty grains; of the infusion, from f ʒj. to f ʒiss.

Officinal Preparation.—Inf. Cuspariæ.

CYDONIA—CYDONIA VULGARIS (Quince).—Icosand. Pentagyn. Pomaceæ. South of Europe.

The seeds, which are the officinal part, abound in mucilage, which is extracted by boiling water. This solution, however, is very liable to spontaneous decomposition, and having no peculiar advantage, is little used.

Medicinal Uses.—The mucilage is recommended as a demulcent in coughs; it has also sometimes been used as an application to erysipelatous surfaces. *Dose,* ad libitum.

Officinal Preparation.—Decoct. Cydoniæ.

CYMINUM—CUMINUM CYMINUM (Cumin).—Pentand. Digyn. Umbellatæ, *Linn.*; Umbelliferæ, *Juss.* South *of Europe.*

Cumin seeds have a strong, peculiar, heavy odour,

and a warm, bitterish taste. In distillation with water, a large proportion of yellow, pungent, volatile oil comes over, which has the strong, disagreeable odour of the seeds.

Medicinal Uses.—Carminative and stomachic; but they are principally employed as an external stimulant in discussing indolent tumours.

DAUCUS — DAUCUS CAROTA (Carrot). — Pentand. Digyn. Umbelliferæ, *Juss.* Indigenous.

The fruit, commonly called the seeds, and the root, are the officinal parts of the carrot. The sensible qualities of the *root* of the *cultivated carrot* are well known; it contains mucilage and saccharine matter. The *seeds* of the *wild carrot* have an aromatic odour, and a warm, pungent taste,—qualities depending on an essential oil, which may be separated by distillation with water.

Medicinal Uses.—The seeds are carminative and diuretic; but they are rarely used. The root is emollient and antiseptic, and is used with advantage, when boiled and beaten to a pulp, as a poultice, to correct fœtid and ill-conditioned sores. *Dose*, of the bruised seeds, from ℈j. to ℥j.

DIGITALIS — DIGITALIS PURPUREA (Foxglove). — Didynam. Angiosperm. Solanaceæ, *Linn.*; Scrophulariæ, *Juss.* Indigenous.

Foxglove is an indigenous biennial plant, generally found growing on the sides of hills and roads, where the soil is dry, sandy, or gravelly; flowering from the middle of June to nearly the middle of August.

The leaves should be gathered when the plant is in flower, and those only which are fresh should be selected. The petioles and midribs being removed, the leaves should be dried either by the heat of the sun, or by placing them on a tin pan or pewter dish before a fire. *The leaves* were formerly the only officinal

part, but the seeds are now introduced into the Materia Medica.

The leaves contain an alkaloid, called *digitalin*, or *digitalia*, which is obtained in fine acicular crystals, soluble in alcohol and ether, but insoluble in water; alkaline in its reaction, and of a very acrid taste. The leaves, like those of other narcotic vegetables, yield, by destructive distillation, an empyreumatic oil, similar in chemical qualities and physiological effects to the empyreumatic oil of henbane.

Medicinal Uses.—Narcotic and sedative; also said to be diuretic. As a sedative, it is employed in inflammatory affections, active hæmorrhages, mania, hypertrophy of the heart, aneurisms, and phthisis pulmonalis, in which it was said to lower the pulse; but its sedative virtues are now not much depended on. As a diuretic, it is given with the best effects in hydrothorax, ascites, and anasarca; but it will not act when the dropsy is attended with paralysis, diseased viscera, or other morbid complications. If administered to persons of florid habits, with much strength, tense fibre, and hot and dry skin, no diuresis ensues. Withering found this medicine most efficacious in those dropsies occurring in persons of a weak, lax fibre, with pale countenance, &c. The diuretic power is checked when much nausea is present; purging also has the same effect, probably owing to its action being diverted from the kidneys to the intestines.

The action of digitalis *as a poison* is treated of in another part of this work.

Doses.—Of the powder, gr. ss. to gr. ij.; of the tincture, ♏x. to ♏xx.; of the infusion, f ℥ij. to f ℥ss.

The extract of foxglove is a very doubtful medicine, as regards its strength; it can conveniently be dispensed with, the above preparations being all that can be necessary for the practitioner.

Officinal Preparations.—Pulv. Digital.—Tinct. Digital.—Infus. Digital.

DIOSMA—DIOSMA CRENATA (Buchu). — Pentand. Monogyn. Rutaceæ, *Juss.* Cape of Good Hope.

Buchu leaves resemble those of senna, but may be distinguished by their petioles being channelled, their upper surface smooth, shining, and of a yellowish-olive colour, and their under surface being rugose, pale, and studded with large open glands. They have an odour like peppermint, and also have a similar taste. They contain a volatile oil, gum, resin, extractive matter, and chlorophyle.

Medicinal Uses.—Tonic, diaphoretic, and diuretic; given in cases of mucous disease of the bladder; also in chronic inflammation of this viscus, and in protracted retention of urine, owing to atony of the bladder. It has been recommended in chronic rheumatism. *Dose,* of the infusion, from f ʒj. to f. ʒiss.

Officinal Preparation.—Infus. Diosmæ.

DULCAMARA—SOLANUM DULCAMARA (Woody Nightshade, Buttersweet).—Pentand. Monogyn. Solanaceæ, *Linn.;* Solaneæ, *Juss.* Indigenous.

The young stalks or shoots of this plant are the parts used in medicine. When first chewed they have a bitter taste, which is soon followed by a degree of sweetishness; whence its name. In common with the Solanum Nigrum, it contains an active principle, called *solania.* This alkaloid may be obtained by adding ammonia to the expressed juice of the berries of the garden nightshade, and taking up the precipitate with boiling alcohol, which deposits it on cooling. *Solania* possesses narcotic properties.

Medicinal Uses.—Narcotic and diuretic. It has been recommended in cases of rheumatism, humoral asthma, dropsy, lepra, psoriasis, and scabies; but it is a remedy of uncertain operation, and is scarcely ever prescribed. *Dose, of* the decoction, f ʒiv. to f ʒi.

ELATERIUM—MOMORDICA ELATERIUM (Wild Cucumber).—Moncœc. Syngenes. Cucurbitaceæ, *Linn., Juss.* South of Europe.*

For medicinal use, the fruit of the wild cucumber should be gathered in September, just before it is ripe; it should then be sprinkled with water; each cucumber cut through longitudinally, and the clear juice which runs from it strained through a sieve. When this is allowed to stand some hours, it deposits a sediment, which, when collected and dried between folds of muslin, constitutes the *Elaterium* of the shops. In preparing this substance, little or no pressure should be employed, in order to prevent the parenchymatous part of the fruit mixing with the extract. The active principle resides almost exclusively in the juice around the seeds. British elaterium, which is the *feculence* that subsides in the juice of the fruit, is the most powerful; French elaterium, which is the *extract* of the same juice, is much weaker; a still weaker preparation, sometimes made, is an extract of the juice of the whole plant.

The active properties of this substance depend on a peculiar crystalline principle named *Elaterine*. It is procured by evaporating the alcoholic infusion of elaterium to the consistence of a syrup, and throwing it into boiling distilled water; upon which a white crystalline precipitate is formed, and more falls down as the water cools. The precipitate, when purified by a second solution in alcohol and precipitation by water, is pure elaterine. Its crystals are microscopic rhombic prisms, striated on the sides. The best British elaterium contains 26 per cent. of the active principle, the worst 15 per cent.; but French elaterium does not contain more than 5 or 6 per cent.

* The fruit of this cucumber, when ripe, becomes so full of *liquid, that it separates* from the stalk, and squirts out its juice *and seeds* with great violence. Hence the name *squirting cucumber.*

Medicinal Uses.—It is a powerful hydragogue cathartic, and as such has been recommended in dropsies, especially in hydrothorax. In ascites, it is reported to have caused the entire evacuation of the fluid, when other most active remedies have failed; but from the uncertainty of its effects, owing in a great measure to the different modes of its preparation, and consequent variable activity, it should not be used in ordinary cases. During its action on the system, there is much fever and vascular excitement produced. *Dose*, gr. ½, gradually increased, until it produces a brisk action on the bowels.

Officinal Preparation.—Extractum Elaterii.

ELEMI—AMYRIS ELEMIFERA (Elemi). — Octand. Monogyn. Terebinthaceæ, *Juss.* Carolina.

This resinous substance is obtained by exudation from the incisions made in the bark of the tree. It is of a pale yellow colour, sometimes with a shade of green, and occasionally with a reddish-brown tint.

Medicinal Uses.—It is used, under the form of an ointment, to promote the discharge from issues, and as a stimulant to foul ulcers.

Officinal Preparation.—Unguent. Elemi.

ERGOTA—ACINULA CLAVUS (Ergot).—Cryptogam. Fungi, Fungaceæ. South of Europe.

According to De Candolle, the Ergot is a parasitic plant, belonging to the natural order Fungaceæ. It grows on the ear of the barley, wheat, and rye, and from its appearance is known by the name of the *spur*. It is, however, more common upon the rye, than upon other grains, and hence the appellation of Secale *cornutum*. Some suppose it to arise from a disease of the grain itself, owing to the germen being punctured, when young, by an insect. In support of this statement, General Field says, "that he saw flies puncture the glumes in the milky state where spurs afterwards

formed, and, imitating their operation with a needle, he obtained the same result." De Candolle and Wiggers agree "that this excrescence is a species of *Sclerotium*, and that the basis of the spur is almost identical in chemical properties with *fungin*."

The spur varies in length from a few lines to two inches, and is from two to four lines in thickness. Its substance is of a dull whitish or grey tint, and is covered by a bluish-black or violet husk, having two, sometimes three streaks of dotted grey. It is tough and flexible when fresh, brittle and pulverizable when dry. Its powder is disposed to attract moisture. A purified extract has been called *ergotin*.

Medicinal Uses.—The ergot possesses the power of increasing the contraction of the uterus when unnaturally languid; consequently it has been employed with frequent good effect to hasten languid natural labour, to promote the separation of the placenta, and to quicken the contraction of the womb after delivery. It is generally supposed to act as a direct excitement on the parturient uterus, causing contraction of it, and consequent expulsion of the child; and is therefore given whenever it is necessary to stimulate the uterus to contract, but should not be given prematurely or when there is a rigid state of the os uteri. Large doses may destroy the fœtus.

This medicine usually acts within a quarter of an hour, and the contractions of the uterus caused by it are constant, and not intermitting, as in natural labour. It has also been found useful in many other kinds of hæmorrhage; menorrhagia; epistaxis; hæmorrhage from the socket of a tooth, &c. *Dose*, of the powder, from ℈j. to ℈ss., repeated to the extent of three doses. It may be administered in a glass of wine, or in a cup of water with about a tea-spoonful of brandy. It has also been given in the form of infusion and of tincture.

Officinal Preparation.—Tinctura Ergotæ Ætherea.

EUPHORBIUM — EUPHORBIUM OFFICINARUM (Euphorbium).—Dodecan. Trigyn. Euphorbiaceæ, *Juss.* Africa.

This resinous substance is obtained by exudation from incisions made in the branches of the plant producing it. It is in small fragments, being perforated or hollow, owing to its being broken off from the prickles around which it exudes.

Medicinal Uses.—Its operation as a drastic cathartic and emetic is so powerful that it is never given internally. Its powder is the most violent of all the errhines, producing a copious discharge of mucus, and sometimes hæmorrhage and inflammation. It is used in veterinary practice to increase the activity of blisters.

FARINA—TRITICUM HYBERNUM (Wheat). —Triand. Digyn. Graminese, *Linn.*, *Juss.*

Farina, or *flour*, is inodorous and nearly insipid. Its principal constituents are gluten, sugar, gum, albumen, fecula or starch, and phosphate of lime. *Gluten*, which is the most nutritious vegetable substance, exists in a larger quantity in wheat than in any other grain. According to Professor Taddei, it is composed of two principles, named by him *gliadine* and *zymome:* the former is soluble in alcohol, and the latter is not. Good flour should strike a blue colour when treated with guaiacum and vinegar.

Medicinal Uses.—Flour is used to sprinkle on the skin in erysipelatous inflammations; also on abraded surfaces, such as those arising from scalds or burns.

Officinal Preparation.—Cataplasma Fermenti.

FERRI PERCYANIDUM (C_{18} N_9 $Fe_{,,}$ or Fe_4 Cfy_9), or Prussian Blue, may be formed by adding peroxide of iron to a solution of the ferrocyanide of potassium. It is, however, generally prepared by placing animal matter, such as dried blood, hoofs, &c., mixed with an equal *quantity of* carbonate of potash, in an iron *vessel. This mixture is to be exposed to a red heat*

for half an hour, or an hour, and when cool is to be treated with water. The solution thus obtained is filtered, and then mixed with sulphate of iron and alum; a precipitate falls down, which is at first of a dingy green colour, but which, by repeated washing with dilute hydrochloric acid, assumes a blue tinge.

Prussian blue is of a rich deep blue colour, insipid, inodorous, and insoluble in water. When submitted to a strong heat, it is decomposed, giving out water, hydrocyanate of ammonia, and carbonate of ammonia, while oxide of iron forms the residue.

Medicinal Uses.—Prussian blue has been given in doses of one grain, repeated several times a day, in cases of intermittent and remittent fevers. In doses of from one to three grains it has been recommended in epilepsy. Mixed with cetaceous ointment, it has been used as an application to cancerous ulcerations.

FICI—FICUS CARICA (Fig Tree).—Polygam. Diœcia, Urticaceæ. Asia.

Figs consist chiefly of mucilage and sugar. They are laxative when used in moderate quantity, but when eaten freely are apt to occasion flatulent colic, and diarrhœa. Figs are also demulcent.

Officinal Preparations.—Confect. Sennæ—Decoct. Hordei Comp.

FŒNICULUM—FŒNICULUM VULGARE (Common Fennel).—Pentand. Digyn. Umbellatæ, *Linn.*; Umbelliferæ, *Juss.* Indigenous.

Fennel seeds have the same properties as those of anise and carraway, and therefore do not require a distinct notice.

Officinal Preparations.—Aq. Fœniculi—Confect. Piper. Nig.—Spir. Junip. Comp.

GALBANUM—BUBON GALBANUM (Galbanum).—Pentand. Digyn. Umbellatæ, *Linn.*; Umbelliferæ, *Juss.* *Syria.*

Galbanum is a gum-resin, which is obtained by *exudation* from incisions made into the stem of the

plant. It is in masses of a variegated texture, tenacious, of a yellowish-brown colour, and a fetid odour. It consists of resin, gum, and a volatile oil. When pure, it is completely soluble in proof spirit.

Medicinal Uses.—Emmenagogue and antispasmodic; used in cases of hysteria and amenorrhœa. Combined with myrrh and ammoniacum, it has been used as an expectorant; it is also said to be aperient. Applied externally, it acts as a discutient.

Officinal Preparations.—Pil. Galb. Comp.—Emplast. Galbani.

GALLÆ—QUERCUS INFECTORIA (Dyers' Oak).—Monœc. Polyand. Amentaceæ, *Linn.*, *Juss.*; Cupuliferæ, *Rich.* Asia Minor.

The tubercles named galls are found on the branches of this tree, their production being caused by a small insect, or fly, the *cynips quercus folii* of Linnæus (*diplolepsis gallæ tinctoriæ* of Geoffroy), perforating the tender shoots, and depositing its eggs in the puncture. This occasions a morbid irritation in the vessels of the part; the gall rises in a few hours, and attains its full size in a day or two, before the larva is hatched. Galls are gathered before the larva within them changes to a fly, and eats its way out; for when this has occurred, the galls become lighter, and contain less of the astringent principle. The best galls are known in commerce by the terms, *black*, *blue*, or *green*; those galls which are *white*, owing to their being pierced by the insect, are of very inferior quality. Galls contain tannin, gallic and ellagic acids, and a concrete volatile oil.

Medicinal Uses.—Galls, though powerfully astringent, are seldom administered internally. Strong infusions or decoctions are used in the form of gargles or injections; and an ointment composed of one part of powdered galls, and eight of simple ointment, has been used as an application to hæmorrhoids. A strong *decoction of galls* applied to warts on the penis destroys

them. For internal exhibition, the *dose* of galls is from gr. x. to gr. xv.

Officinal Preparation.—Unguent. Gallæ Comp.

GENTIANA—GENTIANA LUTEA (Gentian).—Pentand. Digyn. Rotaceæ, *Linn.*; Gentianeæ, *Juss.* Switzerland, Germany.

Gentian root is in long slender pieces, soft and flexible, of a yellowish colour, with a greyish epidermis. It has a very bitter taste, which it imparts to both water and alcohol, and which depends on a peculiar principle, called *gentianine.* Besides this active matter, it contains an odorous principle, a substance resembling bird-lime, a greenish fixed oil, an organic acid, uncrystallizable sugar, gum, yellow colouring matter, and lignin.

Medicinal Uses.—Gentian is a good tonic and stomachic, and as such is frequently given in the form of infusion or tincture, in cases of dyspepsia and loss of appetite. Gentian, in the form of powder has been given in doses of half a drachm in cases of intermittent fever. *Dose,* of the powder, gr. x. to gr. xv.; extract, gr. v. to gr. x.; infusion, f ℥j. to f ℥iss.; tincture, f℥ij. to f℥iij.

Officinal Preparations.—Infus. Gentian. Comp.—Tinct. Gent. Comp.—Extract. Gent. Mist. Gent. Comp.

GLYCYRRHIZA—GLYCYRRHIZA GLABRA (Liquorice).—Diadelph. Decand. Papilionaceæ, *Linn.*; Leguminosæ, *Juss.* South of Europe.

Liquorice root is long, slender, and flexible, covered with a thin epidermis, and has a sweet agreeable taste. Its sweetness depends upon a peculiar principle, named *Glycion* or *Glycyrrhizine.* It is a yellowish substance, of an amber colour, soluble in water and alcohol; sweet, but not susceptible of fermentation; it forms compounds with acids and alkalies, all of which are sweet. By decoction and evaporation, a dark-coloured extract is obtained from the root.

Medicinal Uses.—Extract of liquorice is commonly

used as a demulcent in catarrh, being allowed to dissolve slowly in the mouth, to allay the irritation which produces coughing; it also relieves the sensation of heartburn. The root, in consequence of its sweet taste, is frequently added to infusions of linseed and althæa. It relieves heartburn.

Officinal Preparations.—Extract. Glycyrrh.—Decoct. Aloes Comp.—Decoct. Hordei Comp.—Decoct. Sarzæ Comp.—Infus. Lini Comp.

GRANATUM—PUNICA GRANATUM (Pomegranate).—Icosand. Monogyn. Pomaceæ, *Linn.;* Myrtaceæ, *Juss.* South of Europe.

This is a small shrubby tree, bearing a fruit about the size of an orange, the pulp of which has an agreeable taste, and is used as a refrigerant in fevers. The *bark of the fruit* is the officinal part; and according to Reuss, it contains tannin, mucus, resin, oxidized tannin, and extractive matter. The bark of the root possesses the same sensible qualities.

Medicinal Uses.—Astringent and anthelmintic; as the former, it has been exhibited in diarrhœa, but its chief use is in causing the expulsion of the tape-worm. With this intention it may be given either in the form of powder, infusion, or decoction. A decoction is prepared by boiling ℥ij. of the bark in Oiss. of water, until reduced to f℥x. of which, when cold, a glassful may be given every half hour, until four doses are taken. This generally causes the expulsion of the worm. The powder may be given in doses of ℥ss.

Officinal Preparation.—Decoct. Granati.

GUAIACUM—GUAIACUM OFFICINALE (Guaiac).—Decand. Monogyn. Gruinales, *Linn.;* Rutaceæ, *Juss.* South America and West Indies.

The wood of the tree and a concrete resinous substance are the officinal parts.

The wood is hard and heavy, of a yellowish colour, has little smell, and a slightly warm bitter taste. Its *properties depend on an acrid resinous matter, a small*

proportion of which it contains. The alburnum, or sap-wood, is yellow; the duramen, or hard wood, is of a blackish-brown colour, mixed with green streaks. If it be good, it gives a bluish-green colour when exposed to nitrous-acid fumes.

The *resin*, or *guaiac*, either exudes spontaneously, or from incisions made in the tree. It is also procured by sawing the wood into billets, and boring a hole longitudinally through them; so that, when one end of the billet is laid on a fire, the guaiac, melting, runs through the hole in the opposite end, and is collected in a calabash. It has a resinous aspect; is of a greenish-brown colour externally, and internally presents a mixture of greenish, reddish, and brownish tints. Its powder is at first gray, but soon becomes green when it is exposed to the air and light,—a change which is said to depend on the absorption of oxygen.

Medicinal Uses.—It is a stimulant, alterative, diaphoretic, diuretic, and, in large doses, purgative. It is used in cutaneous diseases, chronic gout, and rheumatism, secondary syphilis, and scrofulous affections of the joints. The cases in which its good effects are most remarkable are those of a secondary syphiloid, or of a chronic rheumatic type. The best mode of administering guaiacum powder is in the form of an emulsion, with mucilage or yolk of egg. *Dose*, of the powder, gr. x to ʒss.; of the tincture, f ʒj. to f ʒiij.; of the mixture, f ʒi. to f ʒij.

Officinal Preparations.—Mistura Guaiaci—Tinct. Guaiaci—Tinct. Guaiac. Comp.—Decoct. Sarzæ Comp.—Pil. Hydrarg. Chlorid. Comp.

HÆMATOXYLUM—HÆMATOXYLON CAMPECHIANUM (Logwood).—Decand. Monogyn. Lomentaceæ, *Linn.*; Leguminosæ, *Juss.* South America.

The wood of this tree is of a deep red colour; it has *scarcely any smell*; its taste is sweetish and astringent. *Its active principle has been named hematine*

it forms crystals of a reddish colour, which have a bitter, astringent, and acrid taste. By boiling in water, a solution is procured, which yields an extract by evaporation.

Medicinal Uses —As an astringent in diarrhœa and chronic dysentery, under the form of decoction, or extract, as a substitute for kino. *Dose*, of the extract, gr. x. to gr. xx.

Officinal Preparation.—Ex. Hæmat. Decoct. Hæmat.

HELLEBORUS — HELLEBORUS OFFICINALIS (Black Hellebore).—Polyand. Polygyn. Multisiliquæ, *Linn.*; Ranunculaceæ, *Juss.* Austria, Italy.

The root of this plant consists of short articulated fibres attached to one head, externally dark-coloured, internally white. Its taste is acrid, which seems to depend on the presence of an oil and resinoid matter.

Medicinal Uses.—Drastic cathartic, formerly much recommended in cases of mania. Owing to its irritant action on the lower portion of the intestinal tube, it has been used in amenorrhœa. In dropsies, it has been employed as a hydragogue purgative, under the form of an alcoholic extract. *Dose*, gr. v. to gr. x.

Officinal Preparation.—Tinct. Hellebori.

HIRUDO—HIRUDO MEDICINALIS (The Leech).—Articulata, Annelidæ, *Cuv.*

The leech is an aquatic worm, common throughout Europe, America, and India. The medicinal leech is characterized by six longitudinal ferruginous stripes, the four lateral ones being interrupted or tesselated with black spots.

Medicinal Uses.—Leeches not only act as local depletives, but also as counter-irritants: hence their application is attended with a twofold good effect.

HORDEUM — HORDEUM DISTICHON (Barley).—Triand. Digyn. Gramineæ. Tartary.

Barley belongs to the same family as wheat. It consists of *hordein*, starch, gluten, sugar, gum, and a *yellow resin.*

Hordeine was discovered in barley by Proust, in 1817. It is insipid, inodorous, yellow, rough to the feel, insoluble in water and in alcohol, and is changeable by nitric acid into acetic and oxalic acids. It resembles much the sawdust of wood, of which it possesses nearly all the chemical properties.

Medicinal Uses.—Barley-water is commonly used as a demulcent and diluent.

Officinal Preparations.—Decoct. Hordei—Decoct. Hordei Compositum.

HYOSCYAMUS—HYOSCYAMUS NIGER (Henbane).—Pentand. Monogyn. Solanaceæ, *Linn;* Selaneæ, *Juss.* Indigenous.

The leaves and seeds are the officinal parts of this plant. The leaves afford a juice which possesses their narcotic properties, and which, when inspissated, forms the officinal extract; the seeds also are narcotic. This plant contains a peculiar principle, named *hyoscyama*, which exists in combination with *gallic acid.* This alkaloid is said to differ from all others in being capable of resisting a low red heat without undergoing decomposition. The seeds contain much more hyoscyama than the leaves. Like other vegetable narcotics, as stramonium, opium, digitalis, tobacco, and hemlock, hyoscyamus yields, by destructive distillation, an empyreumatic oil of great activity.

Medicinal Uses.—Henbane is a narcotic. It has been employed in various painful and spasmodic diseases, as in epilepsy, hysteria, palpitations, mania, and scirrhus. At present it is principally used as a substitute for opium, having the advantage that it does not, like it, produce constipation, but rather relaxes the bowels; further, it does not cause determination to the head, which opium frequently does. But although it soothes, it does not cause sleep, like *opium.* Combined with compound extract of colocynth, *it is* frequently given as a purge—the henbane aiding *the* cathartic action, and at the same time preventing

griping. Given in combination with camphor, it has been found extremely efficacious in chordee, and where there is an irritable condition of the neck of the bladder. A solution of the extract is used to dilate the pupil, but it is less effectual than belladonna. The extract of henbane, as found in the shops, is very variable in strength, some specimens being of great activity, and others nearly inert. It is advisable, therefore, to begin, in all cases, with small doses of this medicine. The relative strength of opium and hyoscyamus is said to be as one grain of the former to ten of the latter. *Dose,* of the extract, gr. iij. to gr. x.

Officinal Preparations.—Tinct. Hyoscyam.—Extract. Hyoscyami.

JALAPA—IPOMÆA JALAPA (Jalap).—Pentand. Monogyn. Convolvulaceæ, *Juss.* Mexico.

The dried *jalap tuber* is imported in round masses, or in transverse slices; it is hard and heavy, of a dark gray colour and striated texture. It has little smell. Its taste is bitter, and subacrid. Its active properties reside in a peculiar resinous matter. The resin—of which it contains about a tenth of its weight—is of a mixed nature, and has been separated by Drs. Buchner and Herberger into two portions, the one possessing the properties of an acid, the other that of a base. The latter they consider the active principle, and have accordingly named it *jalapine.* Both water and alcohol, separately, extract a part, and when mixed take up the whole, of the active constituents of jalap.

Medicinal Uses.—Jalap is a powerful drastic cathartic, producing full evacuations from the intestines, and occasionally causing severe griping. It is generally used in cases where it is desirable to excite a brisk action on the bowels, and also to produce a *derivative* effect. As a cathartic and anthelmintic, it is *generally given with* calomel; as a hydragogue, it is

combined with bitartrate of potash. The latter combination is a powerful remedy in dropsical affections. Biscuits are sometimes medicated with jalapine. *Dose*, from gr. x. to 3ss.

Officinal Preparations. — Extract. Jalapæ — Pulv. Jalapæ Comp. — Pulv. Scammon. Comp. — Tinct. Jalapæ.

INULA—INULA HELENIUM (Elecampane). — Syngenes. Superflua, Synantheraceæ. Indigenous.

Elecampane root consists principally of *inulin*, which differs from starch in not forming a precipitate with iodine, and in being deposited unchanged from its solution in boiling water.

Medicinal Uses.—It is said to be tonic, emmenagogue, and diaphoretic. It is never used except in the confection of pepper, where it might be easily dispensed with.

Officinal Preparation.—Confect. Piperis Nigri.

IODINIUM.—*Medicinal Uses.*—Iodine acts as a general stimulant, but it exerts its power especially on the glandular system. In moderate doses, it promotes the gastric functions, and increases the appetite; but even in small doses it occasionally produces injurious effects by accumulating in the system. Its absorption is so evident that it can be detected in the blood, the urine, and the perspiration. It has been used with advantage in bronchocele, enlarged mesenteric and other glands, scirrhus of the breast and uterus, ovarian dropsy, and scrofulous affections. Its great efficacy in scrofula was first clearly pointed out by M. Lugol. It has been used in tuberculous phthisis, particularly inhaled in the form of vapour. Its action as an emmenagogue was at first disputed, but is now generally admitted. The preparations of iodine are useful in secondary syphilis. It is also sometimes employed in epilepsy, chorea, hysteria, and paralysis. If the use of iodine causes much anxiety great depression of spirits, palpitations, tremors v

sembling chorea, and emaciation, its use must be immediately discontinued. M. Lugol has remarked a peculiarity in the action of iodine, namely, "that women labouring under scrofula, instead of becoming emaciated, as is common during a course of this medicine, gain flesh;" and Majendie has remarked similar effects to occur.

The compound tincture of iodine of the Pharmacopœia may be given in doses of ɱv. to ɱxx.

As a local application, the iodide of potassium is employed with advantage as a friction over scrofulous humours. The usual strength of this ointment is, four parts of iodide, one part of iodine, and thirty-two parts of lard. The ointment of M. Lugol is double this strength. A weak solution of iodine is used as an injection in hydrocele. The continued use of iodine will cause the absorption of the testes and mammæ; it has also an injurious effect on the powers of the stomach.

Officinal Preparations.—Ferri Iodid.—Hydrarg. Iodid. et Biniod.—Plumbi Iodid.—Potass. Iodid.—Liq. Potass. Iodid. Comp.—Pil. Hydrarg. Iodid.—Tinct. Iodin. Comp.—Ung. Hydrarg. Iod. et Biniod.—Ung. Iodin. Comp.

IPECACUANHA—CEPHAELIS IPECACUANHA (Ipecacuan).—Pentand. Monogyn. Rubiaceæ, *Juss.* South America.

The roots of different plants are met with in the shops under the name of ipecacuan. The best is in small twisted ramifications, annulated, of a brown colour, having a faint smell, more obvious in the powder, and a bitter, slightly acrid taste. The larger roots of ipecacuan, which are compact, and break with a resinous fracture, having a whitish-gray, somewhat semi-transparent appearance on the inside of the cortical part, with a pale straw-coloured medullary fibre, should *be preferred.* The powder of ipecacuan should *be kept in well-corked* bottles, and in a dark place,

and a warm sweetish taste, with a degree of bitterness—the former qualities residing in the pulp, the latter in the seeds. They owe their properties to a volatile oil, which may be separated by distillation. Alcohol and water extract their virtues.

Medicinal Properties.—Diuretic, given in dropsies, scorbutic, and cutaneous affections, especially scabies. Juniper is generally used as an adjunct to other diuretics.

Officinal Preparations.—Ol. Junip.—Sp. Junip. Comp.

KINO—PTEROCARPUS ERINACEA (Kino Tree). — Diadelph. Decand. Leguminos., *Juss.* Africa.

African Kino, the product of the tree above mentioned, is rarely met with in the British market. The kino generally found in the shops is brought from India, and is the extract of the *Nauclea Gambir*. The variety of kino imported from New South Wales is the concrete juice of the *eucalyptus resinifera*, or brown gum tree of New Holland.

African kino is in small, irregular, shining fragments, of a deep ruby-brown colour. It is pulverulent, affording a dark chocolate or reddish-brown powder. Water at 60° F. dissolves the larger proportion of it; alcohol takes up two-thirds of it; and ether dissolves about one-third. When taken into the mouth, it is at first insipid, but after some time imparts a degree of roughness, with a scarcely perceptible sweetness. It does not colour the saliva. Kino contains tannin, resinous matter, and mucilage. It should not be combined with alkalies.

Medicinal Uses.—Kino is a powerful astringent, and is given in diarrhœa, chronic dysentery, leucorrhœa, passive hæmorrhages, &c. Catechu, being more uniform in its properties, is preferred to kino. Externally, it has been applied as a styptic, and to give tone to, and diminish the discharge from flabby ulcers. *Dose, of the powder*, gr. x. to ʒss.

Officinal Preparations.—Tinct. Kino—Pulv. Kino Comp.

KRAMERIA—KRAMERIA TRIANDRIA (Rhatany).—Tetrand. Monogyn. Polygaleæ, *Juss.* Peru.

Rhatany root is in long cylindrical ramifications of a reddish colour. Its bitter and astringent properties reside more in the cortical than the ligneous part hence the thin pieces should be preferred.

Medicinal Uses.—Tonic and astringent, used in the same cases as kino and catechu.

Officinal Preparation.—Inf. Krameriæ.

LACMUS—ROCELLA TINCTORIA (Litmus).

This is an indigenous lichen, found in Portland Island; but, as an article of commerce, it is imported from the Levant, and also from the Canary Islands.

In order to obtain litmus, the lichen, after being dried and cleaned, is reduced to powder in a mill. It is then mixed in a vat with one-half its weight of pearlash, and moistened with human urine; fermentation soon succeeds, which is kept up by stirring, and successive additions of urine, until the colour of the material changes first to red and then to blue. In this state it is mixed with one-third of its weight of potass, then dried and cut into small squares for use.

LACTUCARIUM—LACTUCA SATIVA (Garden Lettuce).—Syngenes. Polygam. Æqual. Compositæ. Indigenous.

This species of lettuce is generally cultivated, and from the leaves and stem of it, which contain a pellucid juice, an extract is obtained. The juice, which when in the vessels of the plant is colourless, on being first exposed to the air, becomes milky, and gradually assumes a brownish colour. This, when inspissated, is the *lactucarium.*

Lactucarium resembles opium in taste and odour, as well as in narcotic properties. Some assert that its narcotic properties depend on the presence of *morphia*, but it is more probable it has a peculiar principle of its

own, as Ganzel and others who have examined it, could not obtain morphia.

Medicinal Uses.—It has been proposed as a substitute for opium, as it produces the sedative effects of that substance, without causing its previous stimulant action. This medicine is highly beneficial in allaying the cough accompanying phthisis pulmonalis. It has, also, a soporific influence. *Dose*, gr. ij. to gr. vj.

LAURUS—LAURUS NOBILIS (Bay Tree).—Enneand. Monogyn. Lauraceæ. South of Europe.

The *leaves* and *berries* are officinal. Both have a sweet, fragrant odour, and an aromatic, astringent taste. By distillation, a volatile oil is obtained; a fixed oil may also be procured by expression or decoction. Water distilled from the leaves gives traces of hydrocyanic acid, upon which, probably, their medicinal qualities depend.

Medicinal Uses.—Aromatic, and said to be narcotic, but they are scarcely ever used. Dr. Thomson has found an infusion of bay-berries useful as a local application in impetigo.

Officinal Preparation.—Conf. Rutæ.

LAVANDULA—LAVANDULA SPICA (Common Lavender).—Didynam. Gymnosperm. Labiatæ, *Juss.* South of Europe.

Lavender flowers have a fragrant smell not only when fresh, but dried, and this they preserve for a long time; their taste is warm, bitterish, and pungent. Alcohol takes up their virtues, which depend upon a volatile oil that may be obtained by distillation.

Medicinal Uses.—When combined with alcohol and other aromatics, it is used as a stimulant, under the form of the Compound Tincture of Lavender. The spirit, or solution of the oil in alcohol is used as a perfume; and the dried leaves, in powder, are errhine.

Officinal Preparations. — Spir. Lavand. — Tinct. *Lavand. Comp.*—*Ol.* Lavand.

LIMONES—CITRIS LIMONUM (Lemon).—Polyadelph. Icosand. Aurantaceæ, *Juss.* Asia.

The outer rind of the fruit, the oil from the rind, and the juice, are the officinal parts of the lemon.

The exterior rind of the fruit contains an essential oil in distinct cells, whence it derives its aromatic quality. This oil can be separated by expression or distillation. The dried rind is similar in flavour to that of the orange; but is rather less bitter and aromatic; its flavour is also more perishable.

Medicinal Uses.—The dried rind is used as an adjuvant to tonic and aromatic infusions. The oil is employed as a perfume. For the properties of the juice, *vide* "Acidum Citricum."

Officinal Preparations. — Acidum Citricum.—Inf. Aurant. Comp.—Inf. Gentian. Comp.—Spir. Ammon. Aromat.—Syrupus Limonum.

LINUM—LINUM USITATISSIMUM (Flax).—Pentand. Pentagyn. Linaceæ, *De Cand.*

The seeds of this plant yield a strong mucilage by infusion or decoction in water; by expression they afford a quantity of oil. This being inferior to almond or sweet oil, is seldom used in medicine. The ground seeds are kept in the shops under the name of *linseed meal.*

Medicinal Uses.—The decoction of the seeds is frequently used as a demulcent in gonorrhœa, nephritis, strangury, and catarrh. The linseed meal is used to form emollient poultices; the meal employed for this purpose should not have lost all its oil. The oil, mixed with lime-water, is used as a liniment for burns.

Officinal Preparations.—Cataplasma Lini.—Catap. Sinapis.

LOBELIA—LOBELIA INFLATA (Indian Tobacco).—Pentand. Monogyn. Lobeliaceæ. America.

All parts of this plant possess medicinal properties; but Dr. Eberle states that the root and capsules are most active. The plant is collected in August and

September. When dried, this plant has a slight irritating odour and an acrid taste. It yields its virtues to alcohol and to water.

Medicinal Uses.—Its properties resemble those of the Nicotiana Tabacum. It is a powerful emetic, distressing and long-protracted nausea following its exhibition. It has been used with advantage in asthma, and has also been recommended in whooping-cough, and other affections of the air-tubes. A tincture of this substance is made by macerating two ounces of the lobelia in a pint of proof spirit. *Dose*, ℥x. to xv. or more.

LUPULUS—HUMULUS LUPULUS (Common Hop).—Diœcia, Pentand. Urticeæ, *Juss.* Indigenous.

This plant is much cultivated in England, its strobiles being used to give bitterness to fermented malt liquors. The strobiles of the hop have an odour somewhat fragrant and aromatic, and a bitter taste, with some astringency.

It contains a peculiar principle, named *lupulin*, which forms from one-sixth to one-tenth of its weight. It is a fine yellow powder, mixed with minute particles of the scales; it is inflammable, and when moderately heated, becomes adhesive.

Medicinal Uses.—Tonic and anodyne; used in gout and chronic rheumatism, either in substance or in the form of tincture. It is sometimes given as a substitute for opium, when that drug is inadmissible. A pillow of hops has been used to procure sleep in morbid watchfulness and delirium. Externally, it has been employed as an anodyne application to cancerous sores, either in the form of fomentation or cataplasm. *Dose*, of the extract, gr. v. to gr. x.; of the tincture, f 3j. to f 3ij.

Officinal Preparations.—Extract. Lupul.—Tinct. Lupuli.

MAGNESIÆ SULPHAS ($MgO, SO_3, 7HO, = 123$).—*Sulphate of Magnesia*, or "Epsom Salt," is prepared

on a large scale from bittern, the liquor which remains after most of the common salt of commerce has been obtained from sea-water by evaporation. After the evaporation has gone on a long time, the remaining sea-water is boiled, in order to separate an additional portion of the common salt and part of the water, the sulphate of magnesia being, as it cools, deposited in crystals, which are purified by repeated crystallization. It is also prepared by pouring diluted sulphuric acid upon magnesian-limestone (a compound of carbonic acid, lime, and magnesia), when the carbonic acid is driven off, and sulphates of magnesia and lime are formed. These salts are easily separated, the sulphate of magnesia being very soluble, while that of lime is comparatively insoluble.

This salt crystallizes readily in *quadrangular prisms, terminated by four-sided pyramids;* it is generally obtained in commerce in small acicular crystals. It has a very bitter taste, is very soluble in cold, and still more so in hot water. It is unalterable by exposure to the air.

Medicinal Uses.—It is very much adopted as a purgative, and its action is much promoted by copious dilution. *Dose,* from ℥ss. to ℥iss.

As many cases of poisoning have occurred through *oxalic acid* being mistaken for this salt, I shall here give a few simple tests, by which they may be easily distinguished from each other. Oxalic acid has a very sour taste, while the sulphate of magnesia has a pure bitter taste. Oxalic acid reddens the vegetable blues; sulphate of magnesia has no effect on them. Oxalic acid effervesces with a solution of carbonate of soda or potassa; sulphate of magnesia does not produce effervescence with them, but gives a copious precipitate of carbonate of magnesia. Oxalic acid is entirely dissipated by *heat,* whereas the sulphate of magnesia merely parts *with its* water of crystallization, undergoing no further *change.* Take a little writing ink, and drop it on two

or three of the suspected crystals; if oxalic acid be present, the ink will become of a reddish-brown colour; if sulphate of magnesia, no change will take place.

Officinal Preparation.—It is employed in the preparation of the "Magnesiæ Subcarbonas."

MALVA—MALVA SYLVESTRIS (Common Mallow). —Monadelph. Polyand. Malvaceæ, *Juss.* Indigenous.

The entire plant abounds in mucilaginous matter, which it freely imparts to water by boiling.

Medicinal Uses.—Fomentations and emollient enemata. *Dose*, ad libitum.

MANGANESII BINOXYDUM.—The *binoxide, peroxide,* or *black oxide of manganese* is not used medicinally. It is employed in pharmacy to assist in setting chloride free. The protosulphate of manganese has been given of late in doses of ℈j —℥j. with mag. sulph. to promote the flow of bile. It is in crystals of a pinkish colour.

MANNA—ORNUS EUROPÆA (Flowering Ash). — Diand. Monogyn. Oleaceæ.

This substance, though yielded by several vegetables, is usually obtained from different species of the ash-tree, particularly the species above mentioned. It is procured by spontaneous exudation, but more copiously by incisions made in the bark of the trunk. When it exudes slowly, the manna is more dry and white, and of a texture somewhat granulated; it is collected in chips of wood or straw, and forms what is called *Flake Manna.* When the exudation is more copious, the juice is of a darker colour, and concretes into a soft mass, less pure than the other, and composed of fragments of a gray and white colour intermixed.

Manna consists of a peculiar saccharine matter, named *Mannite,* in the proportion of 75 per cent.; true *sugar; yellow nauseous* matter, on which the *purging depends; and* a little mucilage. Mannite

differs from sugar in not being susceptible of fermentation.

Medicinal Uses.—This substance, though mild in its operation, occasionally produces flatulence and griping; hence it is principally used in combination with other cathartics, especially with senna. It is frequently given to young children as a laxative.

Officinal Preparation.—Conf. Cassiæ.

MARANTA—MARANTA ARUNDINACEA (Indian Arrow-root).—Monand. Monogyn. Marantaceæ. South America.

The starch which is extracted from this root is the officinal part. The *rhizomes*, when a year old, are washed and beaten into a pulp, thrown into water, and agitated, so as to separate the amylaceous from the fibrous part. When the fibres are removed, the milky liquid containing the fecula suspended is strained through coarse linen; this, on being allowed to stand, deposits the officinal portion of the root. What is sold in this country under the name of arrow-root contains much potato-starch, which, however, differs but slightly from the true arrow-root.

Medicinal Uses.—Arrow-root is used as a demulcent in diarrhœa and dysentery, and as an article of diet for convalescents. A kind of jelly is formed by boiling it with water or milk, and it is in this form it is generally given.

MARRUBIUM — MARRUBIUM VULGARE (Common Horehound).—Didynam. Gymnosp. Labiatæ, *Juss.* Indigenous.

This plant has a strong odour, which is diminished by drying, and lost by long keeping. Its bitterness is extracted by water, and by alcohol.

Medicinal Uses.—This substance is used more as a popular remedy than by the profession. It is employed in catarrhs, coughs, &c. It is either given in the form of infusion, or tea, as it is commonly called, or used to flavour syrups and lozenges.

MASTICHE — PISTACIA LENTISCUS (Mastiche). — Dicœcia, Pentand. Terebinthaceæ, *Juss.*

This resinous substance is an exudation from incisions made in the above-named tree, and is imported from the island of Chios. It is in small rounded fragments, of a light yellowish colour, nearly transparent, hard, and brittle, but when pressed or chewed, becoming tenacious. Alcohol dissolves four-fifths of it, leaving a substance which resembles caoutchouc, but differs from it in becoming brittle when dried. This peculiar matter has been named *Masticin.* Mastiche differs from the pure resins in being only partially soluble in alcohol, and being totally dissolved by ether.

Medicinal Uses.—This substance is scarcely ever used as a medicine. From its insolubility and tenacity, it is employed to fill up the cavities in carious teeth, and is sometimes combined with aloes in dinner pills.

Officinal Preparation.—Tinct. Ammon. Comp.

MEL—APIS MELLIFICA (Honey Bee).

Honey is collected by bees from the nectaries of flowers, in which it is abundantly secreted; but it probably undergoes some change in the insect before it is excreted from it, and deposited in the comb. The flavour of the honey varies according to the nature of the flowers from which it is collected. Honey contains a crystallizable sugar, an uncrystallizable sugar, an aromatic principle, an acid, wax, and, according to Guibourt, mannite. The best honey is that which is allowed to drain from the comb; when it has been expressed, it is liable to contain wax and other impurities. When honey is liquefied, these in a great measure separate and rise to the surface, so as to be easily removable.

Medicinal Uses.—Honey has been employed instead of saccharine matter to sweeten some medicinal preparations. It is more laxative than sugar.

Officinal Preparations.—Lin. Æruginis—Mel Boracis—Mel Rosæ—Oxymel—Oxymel Scillæ.

MENTHÆ—MENTHA PIPERITA (Peppermint).—Didynam. Gymnosperm. Labiatæ, *Juss.* Indigenous.

This mint has more pungency than either of the succeeding. The herb has a strong penetrating odour, somewhat like camphor, and a warm pungent taste, followed by a sensation of coolness. By distillation, an essential oil containing camphor is obtained.

Medicinal Uses.—Peppermint is used as a stimulant and carminative, to obviate nausea or griping, or to relieve any symptoms arising from flatulence. It is employed to cover the taste and odour of other medicines.

Officinal Preparations.—Aq. Menthæ Pip.—Ol. Menthæ Pip.

MENTHA PULEGIUM (Pennyroyal).—Didynam. Gymnosp. Labiatæ, *Juss.* Indigenous.

MENTHA VIRIDIS (Spearmint).—Didynam. Gymnosp. Labiatæ, *Juss.* Indigenous.

These two mints, pennyroyal and spearmint, resemble the peppermint in their qualities, but are seldom used, being less agreeable and pungent. The pennyroyal is certainly a powerful emmenagogue.

The *officinal preparations* of pennyroyal are, Ol. Pulegii—Aqua Pulegii.

Those of spearmint are, Aq. Menth. Virid.—Ol. Menth. Vir.—Spir. Menth. Viridis.

MENYANTHES—MENYANTHES TRIFOLIATA (Buckbean).—Pentand. Monogyn. Gentianæ, *Juss.* Indigenous.

This is a small herbaceous plant, found in marshy places. The leaves only are generally found in shops, but the whole plant is officinal.

Medicinal Uses.—This is a strong bitter, and was *formerly* used in scurvy, dropsies, intermittents, &c. *It is now* nearly discarded from practice.

MEZEREUM — DAPHNE MEZEREUM (Mezereon). — Octand. Monogyn. Thymeleæ, *Juss.* Indigenous.

The bark of the root of this shrub is the officinal part; the entire slender twigs of the root are, however, frequently found in the shops. When fresh, mezereon has a nauseous smell; its taste is at first sweetish, but afterwards acrid, and very irritating. Its properties are impaired by drying. M. Dublanc has discovered a peculiar crystalline principle in this bark, in which, probably, the poisonous qualities of the plant reside. It is neither acid nor alkaline. Vauquelin gave the name of *daphnine* to a peculiar principle contained in mezereon.

Medicinal Uses.—Mezereon is a stimulating diaphoretic, which has been found useful in chronic rheumatism, scrofulous enlargements, lepra, and other cutaneous affections. Until lately, it was considered an antisyphilitic of great efficacy when given in conjunction with sarsaparilla. A decoction of mezereon has been used as a stimulating gargle in relaxation of the uvula, and chronic affections of the fauces and pharynx. The root has also been chewed, in order to produce a stimulant effect in these cases. *Dose*, of the substance, gr. v. to gr. x.

Officinal Preparation.—Decoct. Sarzæ Compositum.

MORI—MORUS NIGRA (Mulberry Tree).—Moncec. Tetrand. Artocarpeæ. Persia.

This tree is supposed to be a native of Persia, whence it was brought to Italy, and has since been gradually spread over Europe. The fruit is the officinal part. This is oval, of a dark-reddish colour, and consists of numerous minute berries, united together, and attached to a common receptacle. Mulberries have a sweet, acidulous taste, and abound with a deep blood-red juice, which contains tartaric acid.

Medicinal Uses.—Mulberries are refrigerant and laxative, and prove exceedingly grateful in febrile affec-

tions. They are, however, seldom used as a medicine. The colouring matter of mulberries may be detected in the urine.

Officinal Preparation.—Syrup. Mori.

MORRHUÆ OLEUM.—Cod-liver oil is imported into, and made in, this country from the liver of the cod-fish *Gadus Morrhuæ*. It is transparent, of a pale straw colour, with a peculiar odour, and an oily nauseous taste. It consists of oleate and margarate of glycerin, some biliary matter, with traces of butyric, acetic, and other organic acids, iodine, and bromine, and a very minute quantity of resinous-like matter, termed gaduin, which last is rather an impurity than a constituent part.

Medicinal Uses.—In phthisis and debility generally, it should not be administered during inflammatory action. *Dose*, ℥ij. to ℥j., in orange-flavoured water, or other ingredient.

MOSCHUS—MOSCHUS MOSCHIFERUS (Musk Deer).—D. Mammalia; Ord. Ruminantia, *Cuvier*. Asia.

Between the umbilicus and prepuce of this animal is an oval bag, flat on one side and convex on the other, about three inches long and two inches broad, projecting, with a small aperture, and studded with hairs. This is the musk-bag. In the young animal, it is empty; but in the full-grown, it contains from ℥iss. to ℥ij. of musk, in a liquid state. The best musk is that which is imported in the natural follicle, or, as it is denominated in mercantile language, the *pod*. This is a small bag, about the size of a pigeon's egg, of a brownish colour, lined with a thin membrane, and covered externally with hairs. The best musk is imported from China, an inferior kind from Bengal, and a still baser sort from Russia.

Musk has a powerful aromatic odour; its taste is *bitterish* and heavy; its colour deep brown, with a *shade of* red. It is inflammable, leaving a light spongy *charcoal*. On analysis, it yields ammonia, stearin,

elaine, cholesterine, an acid oil with ammonia, a volatile oil, hydrochlorate of ammonia, chlorides of sodium and calcium, gelatin, albumen, fibrin, carbonate and phosphate of lime, carbonated matter soluble in water, and impurities, such as hair and sand. Boiling water dissolves about eighty parts, alcohol only fifty, and ether nearly all. Hence, ether is the best solvent for this substance.

Medicinal Uses.—Musk is stimulant and antispasmodic; administered occasionally in nervous affections, especially hysteria, epilepsy, and singultus. It has been employed in low typhoid fevers, to relieve the subsultus tendinum. As a stimulant, it has been exhibited in retrocedent gout. Combined with ammonia, it has been found efficacious in cases of gangrene. Musk has been recommended, in the form of enema, in the convulsions of children arising from dentition. It is best given in the form of bolus. *Dose*, from gr. v. to ℈j., repeated every five or six hours if requisite.

MUCUNA—MUCUNA PRURIENS (Cowhage).—Diadelph. Decand. Leguminosæ, *Juss.* East and West Indies.

The down which covers the outer surface of the pods of this plant consists of spiculæ so sharp that they are capable of penetrating the cuticle, and occasioning itching and inflammation. It is these spiculæ which are used in medicine.

Medicinal Uses.—Anthelmintic; used as a mechanical irritant in worm cases. It is made into an electuary with treacle or syrup, of which two or three teaspoonfuls are given to an adult, a strong cathartic being afterwards exhibited. It is worthy of notice, that this substance does not produce any marked intestinal irritation. *Dose*, gr. v. to gr. x.

MYRISTICA — MYRISTICA MOSCHATA (Nutmeg Tree).—Dicœcia, Monadelph. Myristicaceæ. Moluccа Islands.

The seed or kernel of the fruit of this tree is called

nutmeg; the immediate envelope of the kernel is named *mace.* The external covering and pulp of the fruit are removed, and the mace and nutmeg are dried by exposure to the sun.

Nutmegs have a fragrant, agreeable odour, and a warm, aromatic taste. When cut transversely, and examined by the microscope, the dark-coloured veins which run through their substance appear to consist of cellular substance filled with oil, which is the active matter of the nutmeg. Alcohol and ether extract the active qualities of the nutmeg. Distilled with water they afford a fragrant and pungent essential oil; by expression, a sebaceous oil is obtained, which retains their odour, probably owing to some of the volatile oil being expressed with it. The *expressed oil* (which is erroneously called *oil of mace*), when first drawn is limpid and yellow, but on cooling, acquires the consistence of spermaceti, and has somewhat the appearance of Castile soap, being whitish, mottled with reddish-brown.

Mace resembles the nutmeg in its odour and taste, but is more pungent and bitter. It is in thin, flexible pieces, unctuous to the feel, and of a deep reddish-yellow colour.

Medicinal Uses.—Nutmeg is a grateful aromatic. It is sometimes used to relieve nausea and vomiting, or to check diarrhœa. In such cases, it is generally given with wine. It is also employed to cover the taste of unpleasant medicines, and to obviate the nausea they are liable to produce. The oil is sometimes used as an external stimulating application. *Dose,* of the substance, gr. v. to gr. xv.; of the volatile oil, ♏ij. to ♏v., combined with sugar.

Officinal Preparations.—Conf. Aromat.—Spir. Ammon. Arom.—Tinct. Lavand. Comp.—Spir. Myristicæ—Ol. Myristicæ.

MYRRHA—BALSAMODENDRON MYRRHA (Myrrh Tree).—Octand. Monogyn. Burseraceæ. Arabia Felix, Abyssinia.

Myrrh is the juice which flows from the bark of this tree. It consists of gum, resin, volatile oil, bassorin, salts of potash and lime, and impurities. The resin appears to constitute its active matter. Its alcoholic solution is rendered turbid by the addition of water, owing to the separation of the resin.

Medicinal Uses.—Myrrh is a stimulating expectorant and tonic. As an expectorant, it has been given in chronic catarrh, and phthisis pulmonalis. In the latter affection, it is found particularly efficacious when there is an evident ulceration of the lungs without much hectic fever, and where the patient's strength is much reduced by the quantity of expectoration. Combined with iron, it is given as an emmenagogue. Tincture of myrrh is used as a stimulating lotion in sponginess of the gums, and sometimes as an application to foul ulcers. *Dose*, gr. x. to gr. xv.

Officinal Preparations.—Decoct. Aloes Comp.—Tinct. Aloes Comp.—Mist. Ferri Comp.—Pil. Aloes cum Myrrha.—Pil. Ferri Comp.—Pil. Galban. Comp.—Pil. Rhei Comp.

NUX VOMICA—STRYCHNOS NUX VOMICA (Vomica Nut).—Pentand. Monogyn. Strychneæ, *Juss.* East Indies.

The kernel, or seed of the fruit, is the officinal part of this tree. The seeds are flat, circular, somewhat like buttons, with a velvety covering of very delicate fibres attached to the coating which invests the kernel. They are so hard that they cannot be reduced to powder by beating, but require to be filed or rasped down. The properties of *strychnia*, the active principle of this vegetable, are noticed both in the pharmaceutical and toxicological sections of this work.

Medicinal Properties.—Nux vomica (and necessarily strychnia) is tonic and stimulant, acting chiefly on the motor tract of the spinal cord. It is chiefly employed in cases of paralysis unattended by organic *lesion of the cerebro-spinal* system. It is consequently

most efficacious in those cases of paralysis dependent on the action of lead. When it is taken by a paralytic person, its action on the paralysed part is announced by a sense of tingling, and an involuntary contraction of the muscles of the part, also a local perspiration. In small doses, it increases the appetite, diminishes the alvine evacuations, and, in some cases, produces symptoms of intoxication. It has been recommended in chorea, dyspepsia, and dysentery. In the last affection, it is a powerful remedy in cases in which there is a discharge from the bowels, without any inflammatory action. It is said to be useful in paralysis of the bladder, incontinence of urine from paralysis of the sphincter vesicæ, and in amaurosis.

Officinal Preparation.—Strychnia.

OLIBANUM—BOSWELLIA SERRATA (Olibanum Tree).—Decand. Monogyn. Burseraceæ. India.

Olibanum consists of yellowish rounded tears, generally covered with a white powder produced by friction. It has a resinous, balsamic odour, and an acrid, rather aromatic taste. It is composed of gum, resin, and volatile oil.

Medicinal Uses.—It was at one time used as an expectorant, but is now merely employed in the preparation of plasters.

OLIVÆ OLEUM—OLEA EUROPÆA (Olive Tree).—Diand. Monogyn. Jasmineæ, *Juss.* South of Europe.

Olive oil is obtained by expression from the *drupe*, or fruit, of the olive. The best oil is made in Provence, owing to the olives being carefully gleaned; but the oil imported into this country comes from Lucca and Florence. Pure olive oil is nearly inodorous, insipid, pale, of a greenish-yellow colour, inflammable, incapable of combining with water, and nearly insoluble in alcohol. When much exposed to the air, *sebacic* acid and water are formed, and the oil then *becomes* brown-coloured, has a disagreeable smell, and

is said to be *rancid*. Its tendency to rancidity is increased by heat, or by the admixture of poppy oil, with which it is frequently adulterated.

Medicinal Uses.—Olive oil is demulcent and laxative. It is also given internally to mitigate the action of poisons; and, by some, used to destroy worms by stopping their respiratory pores. It is chiefly used in pharmacy in the preparation of liniments, cerates, ointments, and plasters.

Officinal Preparations. — Ceratum — Ceratum Calaminæ—Cer. Cetacei—Cer. Plumb. Acetat.—Cer. Plumb. Comp.—Cer. Resinæ—Cer. Saponis—Empl. Ammon. cum Hydrarg.—Empl. Hydrarg.—Empl. Picis—Lin. Ammon.—Lin. Ammon. Sesquicarb.—Lin. Camphoræ—Ung. Cetacei—Ung. Elemi—Ung. Hydrarg. Nitrat.—Ung. Picis Nig.—Ung. Plumb. Compositum.

OPIUM—PAPAVER SOMNIFERUM (White Poppy).—Polyand. Monogyn. Papaveraceæ, *Juss.* Europe. Asia.

The white poppy is a native of the warmer regions of Europe and Asia: it also grows in colder climates without any sensible diminution of its powers. All parts of the poppy, except the seeds, contain a white, opaque, narcotic juice, but it is more abundant in the capsules; hence these are the officinal parts of the plant. When the capsule has nearly attained maturity, longitudinal incisions are made in its sides, care being taken that they do not penetrate into the cavity. This is done in the evening; the milky narcotic juice exudes from the vessels of the capsule, and adheres to the sides of the incisions. This is collected in the morning, and a considerable quantity being obtained, it is inspissated in the sun. The inspissated juice (*opium*) is next formed by the hand into cakes, which are laid in earthen basins to be further exsiccated, and then are covered with poppy or tobacco leaves.

Opium is imported into this country in chests from

Turkey and India. The *Turkey* opium is in flat pieces, covered with leaves and the reddish capsules of a species of *rumex*, which is considered an indication of its goodness, as the inferior kinds of opium have none of these capsules adhering to them. Turkey opium contains about one-fourth part of impurities.

East Indian Opium is in round masses, covered with the petals of the poppy in successive layers, to the thickness nearly of one-fourth of an inch. It is generally much adulterated.

Opium has a reddish-brown colour, and its fresh surface glistens when cut. It is commonly soft and plastic; but, if pure, may be dried so as to become brittle. Its odour is strong and somewhat fetid; its taste is peculiar, very bitter, and somewhat acrid. On analysis, it has been found to contain *morphia, codeia, paramorphia, pseudomorphia, narcotine, narceine, meconine, meconic acid,* gum, resin, extractive matter, sulphates of potash and lime, gluten, and a matter resembling caoutchouc.

The most important of these principles is morphia, which is found in opium in combination with the meconic acid. Morphia and its salts have been noticed in the pharmaceutical section of this work.

Narcotine is obtained by the action of sulphuric ether on opium. When pure, it is in transparent, colourless, pearly crystals, which, when crystallized from sulphuric ether, are prisms with a rhombic base. If perfectly pure, they do not undergo the changes produced on morphia by a persalt of iron or nitric acid. This substance was formerly supposed to be the stimulant principle of opium.

Codeia, or *Codeine,* is, like morphia, an alkaloid, capable of combining with acids. It differs from morphia and narcotine in being moderately soluble in *water;* and from this solution it may be obtained in *large octahedral crystals.* It is said to be the *stimulant principle of opium.*

Meconic acid may be obtained by treating the meconates of lead or magnesia with dilute sulphuric acid; a sulphate of lead or magnesia being formed, and meconic acid remaining in solution. The acid is deposited in impure scaly crystals by evaporation, and is of a pale brown or yellowish tint, being rendered so by adhering resin or extractive matter; but when very pure, and nearly colourless, it forms long, delicate, tabular crystals, which in mass have the appearance of spermaceti.

The other constituents of opium do not require distinct notices.

Medicinal Uses.—Opium is a narcotic, anodyne, soporific, antispasmodic, diaphoretic, and astringent. The effect of a small dose of opium seems to be generally in the first instance stimulating; the action of the heart and arteries is increased, and a slight sense of fulness is caused in the head. The extent of stimulation varies in different persons; it is, however, generally very slight. By repeating small doses frequently, the stimulation may be kept up for a considerable time, in some people; hence the extraordinary effects said to be experienced by opium-eaters. The sedative effects which follow the primary stimulant action of opium are much greater than could be anticipated from the extent of excitement produced by it. Opium has been given in large doses in delirium tremens, tetanus, hydrophobia, some forms of convulsions, and neuralgies, spasmodic affections, passage of urinary and biliary calculi, and in some acute inflammatory affections after bleeding. Dr. Armstrong strongly recommended this substance in doses of three or four grains, after bleeding, in some most acute diseases; as in inflammation of the lungs, and of the peritoneal covering of the stomach, intestines, and uterus. It is useful as an adjuvant to wine and tonics in low typhoid fevers. Opium is generally combined with *calomel in acute inflammations*, in which cases it not

alone diminishes pain, and lessens nervous irritability, but also prevents the calomel passing off by the bowels. Combined with calomel and tartarized antimony, it has been found exceedingly beneficial in rheumatism. It has also been recommended in cases of spasmodic asthma; further, it is a most useful remedy in persistent vomiting, arising from morbid irritability of the stomach, in pyrosis, and in gastrodynia. Alone, or combined with calomel, or ipecacuan, it has been found useful in enteritis, colic, muco-enteritis, and dysentery. The exciting effects of opium may last nearly an hour, the sedative influence generally continues for six or eight hours. Opium is liable to produce headache, costiveness, impaired appetite, and bad digestion. It produces constipation by causing torpor of the intestines, and by checking the secretion of bile. This state of the intestinal canal is best relieved by calomel and aloetic purges. It is often productive of considerable benefit in threatened abortion, and also in protracted labour owing to rigidity of the os uteri. Opium should not be given to children if it can be possibly avoided; nor should it be administered to mothers who are giving suck, without cautioning them not to give suck for some hours after. Opium is contra-indicated when the person is very plethoric, when there is an apoplectic or congestive tendency, when the bowels are naturally sluggish, in acute inflammations before bleeding, and in some persons it is totally inadmissible, owing to a peculiar idiosyncrasy of habit. Opium, either in the form of enema or suppository, is frequently used in painful affections of the uterus, bladder, or urethra; or in cases where the exhibition of anodynes or sedatives, by the mouth, is contra-indicated. As an external application, either in the form of liniment, plaster, or otherwise, opium *possesses* powerful anodyne properties. *Dose*, of *opium*, as a stimulant, gr. ¼ to gr. ½, twice or three *times* a day; as an anodyne, or soporific, gr. ½ to

gr. iss.; as a sedative and antispasmodic, gr. j. to gr. iij.

Officinal Preparations.—Confect. Opii—Empl. Opii—Enema Opii—Extract. Opii Purific.—Lin. Opii—Pil. Ipecac. Comp.—Pil. Saponis Comp.—Pulv. Cretæ C. cum Opio—Pulv. Ipecac. Comp.—Pulv. Kino Comp.—Tinct. Camphoræ Comp.—Tinct. Opii—Vin. Opii.

OPOPONAX—OPOPONAX CHIRONIUM (Rough Parsnip).—Pentand. Digyn. Umbellatæ. South of Europe.

The gum-resin opoponax is obtained by making incisions into the base of the stem, from which a juice exudes, which becomes inspissated by exposure to the air and sun.

Medicinal Uses.—This substance was formerly employed as an emmenagogue, but it is now discarded from use. *Dose*, gr. x. to ℈j.

ORIGANUM—ORIGANUM VULGARE (Common Marjoram).—Didynam. Gymnosperm. Labiatæ, *Juss.* Indigenous.

This plant has an agreeable aromatic odour, and a warm pungent taste resembling thyme. These properties reside in a volatile oil, which may be obtained by distillation with water.

Medicinal Uses.—Common marjoram is regarded as tonic, stomachic, and emmenagogue. It is chiefly used as a counter-irritant.

Officinal Preparation.—Ol. Origani.

OVUM—PHASIANUS GALLUS (Dunghill Fowl).—D. Vertebrata. Cl. Aves. Ord. Gallinaceæ.

The egg of the common fowl is used for several purposes in medicine.

For the sake of description, it may be divided into four parts: the white, the yolk, the membrane enclosing them, and the shell.

The *white, or albuminous portion*, of the egg is *insipid and inodorous*, of a viscid nature, readily soluble

in water, coagulable at 165° F., also coagulated by acids and alcohol. The *yolk* also is inodorous, but has a bland oily taste; when agitated with water, it forms a milky emulsion. It consists of water, oil, and albumen; on the presence of the albumen depends the hardness of the boiled yolk. The *shell* consists of carbonate of lime, phosphate of lime, and animal mucus. When burnt, the animal matter and carbonic acid are driven off, and lime, with phosphate of lime, remains.

Medicinal Uses.—The albuminous portion is used as an antidote to corrosive sublimate and other acrid poisons; it is also employed for clarification. The yolks of raw eggs are gently laxative, and have been thought useful in jaundice and other hepatic obstructions. Beaten up with sugar and wine, they are nutritive in the stage of convalescence. In pharmacy, the yolks are employed to render oils and balsams miscible with water. The shells are antacid, but possess no particular qualities to render them preferable to chalk when unburned, or lime when burnt.

Officinal Preparations.—Mist. Spir. Vini Gallic.

PAPAVER.—*The dried capsule* of the poppy (*papaver somniferum*) is inodorous, and nearly insipid, a very slight degree of bitterness being perceptible when it is long chewed. By decoction with water it yields its virtues; and when the decoction is evaporated, an extract is obtained, with properties similar to opium, but much less powerful.

Medicinal Uses.—The extract of poppy is occasionally used as a substitute for opium, it being less liable to cause nausea, headache, and delirium. It is therefore to be preferred for procuring sleep in diseases which the head is much affected. Most practitioners, however, in these cases, use extract of henbane. A decoction is a very useful fomentation in painful swellings, and in the excoriations produced

thin acrid discharge of ulcers. It has been used as an injection into the vagina in cases of scirrhus uteri. *Dose,* of the extract, gr. v. to gr. xv.

Officinal Preparations.—Decoct. Papav.—Extract. Papav.—Syrup. Papaveris.

PAREIRA — CISSAMPELOS PAREIRA (Pareira). — Dicœcia Monadelph. Menispermaceæ. Brazil, West Indies.

The root of this shrub, which is the officinal part, is in solid, dark-coloured pieces, wrinkled on the surface, and of a dark-brown colour. Water extracts its active properties.

Medicinal Uses.—It is said to be tonic, aperient, and diuretic; given in cases of chronic disease of the kidney, irritability of the bladder, with mucous discharge, leucorrhœa, dropsy, and phosphatic calculous affections. *Dose,* ℥ss. to ℥j.

PETROLEUM—MINERAL TAR (*Petroleum Barbadense*), as usually kept in the shops under the name of Barbadoes Tar, is thick, of a dark-brown colour, having a fetid smell, and a warm bitter taste. Like most other bitumens, it is chiefly composed of carbon and hydrogen.

Medicinal Uses.—It has been employed as an expectorant and antispasmodic in asthma and chronic catarrh; externally, it has been used as a stimulating application in rheumatism and paralysis.

PIMENTA—MYRTUS PIMENTA (Jamaica Pepper, or Allspice).—Icosand. Monogyn. Myrtaceæ, *Juss.* West Indies.

The berries of this tree are collected before they are ripe, and dried in the sun. Their flavour is fragrant, and has been compared to that of a mixture of cinnamon, cloves, and nutmeg, whence the name of allspice. Their taste, though pungent, is less so than that of the peppers; their flavour resides in a volatile oil; *their pungency in a* green fixed oil and a resin.

Medicinal Uses.—An aromatic stimulant, used

chiefly as an adjunct to tonics and purgatives. *Dose*, gr. x. to gr. xv.

Officinal Preparations.—Aq. Piment.—Spir. Piment.—Syrup. Rhamni—Ol. Piment.

PIPER CUBEBA (Cubebs, or Java Pepper).—Diand. Trigyn. Piperitæ. East Indies.

The berries grow in clusters like currants, on partial peduncles, which remain attached to them, whence they have received the name of *piper caudatum*. When dried they have a wrinkled surface, brown colour, a warm, pungent, aromatic, and slightly bitter taste, but much milder than the common pepper.

They are occasionally adulterated with the berries of the *rhamnus catharticus*, and with those of *pimenta*. The best means of distinction is by the seeds, the cubebs containing but *one*, while the pimenta contains *two*, and the rhamnus catharticus has *four*.

According to the analysis of Vauquelin, this pepper is composed of a volatile oil which is nearly solid, *a resin resembling copaiba*, a coloured resin, a colouring gummy matter, an extractive matter similar to that of legumes, and some saline substances. The volatile oil is the active ingredient.

Medicinal Uses.—Stimulant, stomachic, and diuretic. When taken internally, it opens the bowels, increases the discharge of urine, and gives to it its peculiar smell. It is chiefly used in cases of gonorrhœa, gleet, and leucorrhœa; in which affections it is held in high esteem as a remedy. It may be given in any stage, provided the bowels are kept open. One to two drachms should be given twice a day, and continued for a day or two after the discharge has ceased. In over-doses it causes fever and a rash; to be treated by purgatives. The tincture is an excellent preparation, and may be used in doses of f 3j. to f 3iij. twice a day.

Officinal Preparations. — Pulv. Cubebæ — Tinct. Cubebæ.

PIPER LONGUM (Long Pepper).—Diand. Trigyn. Piperitæ. Bengal.

This is a berry or fruit of another species of pepper gathered before it is ripe, and dried in the sun. It is oblong, indented on the surface, has a weak odour, and a fiery pungent taste. It contains piperine, a concrete oil on which its acrimony depends, and a volatile oil.

Medicinal Uses. — Its qualities are similar to the black pepper.

Officinal Preparations.—Conf. Opii.—Pulv. Cretæ Comp.—Tinct. Cinnam. Comp.

PIPER NIGRUM (Black Pepper),—Diand. Trigyn. Piperitæ. East Indies.

Black Pepper is the unripe fruit of this plant dried in the sun. Its taste is pungent, and its odour aromatic. The taste and smell are owing to an acrid essential oil; besides which, there exists in pepper a peculiar principle, named *piperine*, a coloured gummy substance, extractive matter, bassorin, uric and malic acids, lignin, and various salts.

White Pepper is the ripe berries of the same plant, freed from the outer covering, and dried in the sun.

Piperine was discovered by M. Pelletier in the black pepper. It is in colourless prisms, transparent, nearly tasteless, insoluble in cold water, but slightly soluble in hot; soluble in alcohol and in ether. It is obtained by treating the black pepper with alcohol.

Medicinal Uses. — Stimulant and aromatic; used chiefly as a condiment to promote digestion. As a medicine, it is employed to relieve nausea, and as a stimulant, in retrocedent gout and paralysis. Under the form of confection, it is much used in cases of hæmorrhoids. *Piperine* has been recommended in intermittents, and is said to be nearly equally efficacious with quina. In very large doses, pepper has proved fatal as an irritant poison.

Officinal Preparations.—Confect. Pip. Nigri—Confect. *Rutæ.*

PIX LIQUIDA—PINUS SYLVESTRIS (Scotch Fir).—Moncœc. Monadelph. Coniferæ.

In order to obtain *tar*, the wood in billets is heaped into a pile, which is covered with turf and kindled at the top; it burns slowly; the resin is melted out and sinks into a cavity below the pile; it is mixed with empyreumatic oil, pyroligneous acid, and the charcoal of the wood, forming a thick black fluid, which is the liquid pitch, or tar. Tar yields a portion of its constituents to water, forming what is called tar-water.

Medicinal Uses.—Expectorant, diuretic, and diaphoretic; given in cases of chronic bronchitis, or catarrh. It has been much extolled in phthisis, and I have certainly seen much advantage derived in this affection from the employment of tar-water. It has been recommended in lepra and other scaly diseases. In the form of ointment, it has been used in tinea capitis, and as an application to sluggish ulcerations. *Dose*, gr. x. to gr. xx. three times a day.

Officinal Preparation.—Ung. Picis Liquidæ.

PIX NIGRA.—By boiling, tar loses its oil and acid, and becomes solid; the residue is the *black pitch* (Pix Nigra).

Medicinal Uses.—According to Dr. Bateman, when taken internally, it is serviceable in ichthyosis. It is employed externally as a stimulant application.

Officinal Preparation.—Ung. Picis Nigræ.

PLUMBI CARBONAS (PbO, CO_2)—PROTOCARBONATE OF LEAD (*White Lead*), or the *ceruse* of painters, occurs native in white prismatic crystals, derived from a right rhombic prism. It is obtained by mixing a solution of an alkaline carbonate with that of acetate of lead. It is composed of one atom of protoxide of lead and one atom of carbonic acid.

Medicinal Uses.—It is not employed as an internal remedy; externally, it is used (very improperly) to sprinkle excoriated surfaces. This preparation of lead is considered to be more poisonous than any other.

PORRUM — ALLIUM PORRUM (Leek). — Hexand. Monogyn. Liliaceæ. Switzerland.

This plant is a native of Switzerland, but is now cultivated in most parts of Europe. The bulb is the officinal part.

Medicinal Uses. — Diuretic, expectorant, and counter-irritant, like garlic, but not so powerful.

POTASSÆ BITARTRAS ($KO, HO, C_8 H_4 O_{10}$).—BITARTRATE OF POTASS is the salt deposited in wine-casks during the slow fermentation which wine undergoes on being kept. There are two kinds of "*tartar*," as it is commonly called; one of a reddish colour, which is deposited from red wines; the other, of a lighter shade, from white wines. It is purified by boiling it with white clay, which attracts the colouring matter; and from the liquor, strained while hot, crystals of the bitartrate of potass are obtained. It may also be procured by adding tartaric acid to a solution of tartrate of potass, minute crystals of the bitartrate being deposited.

The crystals of bitartrate of potass are small and irregular, and have rather a harsh, sour taste. They are sparingly soluble in water, requiring for solution about 120 parts of that liquid at 60°, and 30 parts at the boiling point. Bitartrate of potass is also soluble in alcohol.

The bitartrate of commerce is generally adulterated with a portion of the tartrate of lime. This may be detected by boiling it in fifteen or twenty times its weight of water, and adding a solution of potass, until the excess of tartaric acid is neutralized. Tartrate of potass remains in solution, and any insoluble earthy compounds are precipitated.

Medicinal Uses.—It acts as a hydragogue cathartic in doses of from ʒiv. to ʒvj., and is given in dropsies with considerable advantage. When given in small doses, it acts solely as a diuretic. Combined with jalap *it is principally administered* in ascites. A solution

of this salt in water, sweetened with sugar, with lemon-rind to give it a flavour, forms an excellent refrigerant drink in fevers.

Officinal Preparations.—Acid. Tartaricum—Antimon. Potassio-Tart.—Ferri Potassio Tart.—Potass. Tart.—Sodæ Potassio Tart.—Pulv. Jalap. Comp.

Potassæ Chloras ($K\,O$, $Cl\,O_5 = 124$).—This salt, formerly called *Oxymuriate*, or *Hyperoxymuriate of Potash*, is made by transmitting chlorine gas through a concentrated solution of potass, until all the alkali is neutralized. 5 eq. of potassa ($K_5\,O_5$) give all their oxygen to one of chlorine to form one of chloric acid, which unites with one of potassa; whilst the 5 potassium combine with 5 of chlorine.

6 eq. potassium K_6 } + 6 chlorine, Cl_6
6 eq. oxygen O_6 }
yield
1 eq. chlorate of potassa = $Cl\,O_5 + K\,O$
5 eq. chloride of potassium = $Cl_5 + K_5$

On evaporating, the chlorate of potass crystallizes, while the chloride remains in solution. The crystals, after being washed with cold water, may be purified by a second crystallization.

This salt is colourless, and crystallizes in four and six-sided scales of a pearly lustre. It is anhydrous.

It is soluble in sixteen times its weight of water at 60°, and in two and a half at the boiling point. It can bear a heat of 600° without undergoing decomposition. At a low red heat, it yields pure oxygen gas, chloride of potassium being the residue.

Medicinal Uses.—It has been recommended as a stimulant tonic in low typhoid fever, and malignant small-pox and scarlatina. It has also been used in scurvy and in syphilis. It is said to act by imparting oxygen to the system. It has been used in cholera. As a remedy in syphilis, it has fallen into disrepute.

Dose, gr. v. to gr. x.

POTASSÆ NITRAS (KO, NO_5).—NITRATE OF POTASS is generated spontaneously in the soil, and crystallizes upon its surface in various parts of the world, and especially in the East Indies, whence the greater part of the nitre used in this country is imported. In some parts of the Continent, it is prepared artificially from a mixture of common mould, or porous calcareous earth, with animal and vegetable substance containing nitrogen. When a heap of these materials, preserved moist in a shady situation, is moderately exposed to the air, nitric acid is gradually generated, through the oxidation of ammonia, and unites with the potassa, lime, and magnesia, which are commonly present in the mixture. On dissolving these salts in water, and precipitating the two earths by carbonate of potass, a solution is formed, which yields crystals of nitrate of potass by evaporation.

Nitrate of potass is a colourless salt, which crystallizes readily in six-sided prisms. Its taste is saline, accompanied with an impression of coolness. It is soluble in seven parts of water at 60°, and in its own weight of boiling water. It contains no water of crystallization, but its crystals always contain some water mechanically lodged within them. It is composed of one atom of nitric acid and one atom of potass.

Medicinal Uses.—Nitrate of potass is diuretic and refrigerant. It has been employed in febrile affections, dropsies, and to relieve the ardor urinæ in gonorrhœa. It has been used in acute rheumatism, and in hæmoptysis. When given in repeated doses, it lowers the pulse, and is detectable in the urine. One drachm of the salt, dissolved in six ounces of water, has been used as a gargle in cynanche. *Dose*, gr. x. to gr. xv.

Officinal Preparations. — Acid Nitric. — Antim. Potassio-Tart.—Ung. Sulph. Comp.

POTASSII FERROCYANIDUM (FeCy, 2KCy, 3HO = 213).—*The Ferrocyanide of Potassium* is prepared by *putting into an iron pot* brought to a moderate ignition,

a mixture of good pearlash and dry animal matters, of which hoofs and horns are the best, in the proportion of two parts of the former to five of the latter. The mixture as it calcines, assumes a pasty form, during which transition it must be briskly stirred. When the evolution of the fetid animal vapours has ceased, and the chemical compound is formed, the mass is to be removed.

When this substance is treated with water, ammonia is given out; on filtering the solution, and evaporating, yellow crystals of the *ferrocyanide of potassium* are obtained. This salt, when added to a protosalt of iron, gives a white precipitate, which becomes a blue by exposure to the air; with a per-salt, it gives a precipitate of Prussian blue. It is only used in making the

Officinal Preparation.—Acid. Hydrocyanicum.

PRUNA — PRUNUS DOMESTICA (Plum Tree).—Icosand. Monogyn. Amygdaleæ. South of France.

The prunes or dried plums are mildly laxative and nutritious. If taken too largely, they are apt to cause flatulence and griping. They form an ingredient in laxative electuaries.

Officinal Preparation.—Confect. Sennæ.

PTEROCARPUS—PTEROCARPUS SANTALINUS (Red Sanders).—Diadelph. Decand. Legumin., *Juss.* India.

Red Sanders Wood has a very deep red colour, which it yields to alcohol, but not to water. It is kept in the shops in the form of chips, raspings, or coarse powder. Its colouring matter has been named *santalin.*

PYRETHRUM—ANTHEMIS PYRETHRUM (Pellitory of Spain). — Syngenes. Polygam. Superfl. Compositæ. South of Europe.

This plant is cultivated in this country, but the root found in the shops is generally imported from Spain. The dried root is in pieces of about three or four inches in length. Its taste is hot and acrid, its acrimony re-

siding in a fixed oil, which alcohol and sulphuric ether dissolve, forming very acrid solutions.

Medicinal Uses.—Stimulant and sialogogue; used almost exclusively in toothache, in which cases it sometimes affords relief. It has been recommended to be chewed in paralysis of the muscles of the tongue, or of those of deglutition.

QUASSIA—QUASSIA EXCELSA (Quassia).—Decand. Monogyn. Rutaceæ, *Juss.* West Indies.

The wood of this tree is of a yellowish-white colour; it is inodorous, and has an intensely bitter taste. It is imported into this country in billets, and is reduced into chips, or rasped, by the druggists. *Quassine*, the bitter principle of quassia, is obtained by evaporating the aqueous decoction of the wood. It is of a brownish-yellow colour, soluble in water and weak alcohol, insoluble in absolute alcohol and ether.

Medicinal Uses.—It is a valuable tonic, given in dyspepsia, diarrhœa, and in remittent and intermittent fevers. After worms have been removed from the intestines, quassia forms an excellent medicine to restore the health and to prevent worms again being generated. It is frequently combined with other tonics, especially with iron; but much more of it is used by brewers than by the faculty. *Dose*, of the infusion, f ℥j. to f ℥iss.

Officinal Preparation.—Inf. Quassiæ.

QUERCUS—QUERCUS PEDUNCULATA (Oak).—Moncœc. Polyand. Cupuliferæ, *Rich.* Indigenous.

The bark of this tree is officinal. It should be collected in the spring, and from branches of about three or four years old. This bark contains a very large proportion of tannin, with gallic acid, and extractive matter. Infusion of oak bark does not precipitate tartarized antimony.

Medicinal Uses.—Oak bark has been used as a remedy in hæmorrhage, diarrhœa, and intermittent fever, *given in doses of* from fifteen to thirty grains.

In modern practice, its decoction is occasionally employed as an injection in leucorrhœa and profuse menorrhagia, and as a fomentation in hæmorrhoids and prolapsus ani. *Dose*, of the powder, gr. x. to gr. xxx.; of the decoction, f ℥ j. to f ℥ ij.

Officinal Preparation.—Decoct. Quercus.

RESINA.—The solid residue after the distillation of the oil of turpentine from the common turpentine (*Terebinthina Vulgaris*) is *yellow resin*.

Medicinal Uses.—It is employed in the preparation of ointments and plasters, and is sometimes given in pills for the piles.

Officinal Preparations.—Cer. Resinæ—Empl. Cere—Empl. Resinæ—Empl. Picis.

RHAMNUS—RHAMNUS CATHARTICUS (Buckthorn).—Pentand. Monogyn. Rhamneæ, *Juss.* Indigenous.

Purging Buckthorn berries are very succulent; they have an unpleasant odour, and an acrid, rather bitter, nauseous taste.

Medicinal Uses.—Their expressed juice has a cathartic action. A syrup of these berries is occasionally given to children; it is, however, liable to produce thirst and griping, and is therefore seldom employed. *Dose*, f ℥j. to f ℥iij.

Officinal Preparation.—Syrupus Rhamni.

RHEUM—RHEUM PALMATUM (Rhubarb).—Enneand. Trigyn. Polygoneæ. *Juss.* Tartary.

It is yet a matter of doubt from what plant the officinal rhubarb is obtained. It has been at different times supposed to be the product of the R. compactum, R. undulatum, and the R. palmatum. These have been cultivated in this country, and good rhubarb obtained from them; yet it is doubtful whether the Russian or Turkey rhubarb, which is of a superior quality, be derived from any of these.

The best rhubarb is the produce of Chinese Tartary; it is in small pieces, with a hole in the centre, to admit of its drying more quickly; it is of a lively yellow

colour, with streaks of white and red; has a peculiar and somewhat aromatic odour, and a slightly astringent bitter taste. Another kind brought from China is known in the shops as Indian rhubarb; it is in large masses, more compact, heavier, and less fine in the grain than the other; it has a much less aromatic flavour.

Rhubarb consists of a peculiar yellow colouring matter (*rhubarbarine* of Caventou), a fixed oil, starch, gum, lignin, oxalate of lime, super-malate of lime, phosphate of lime, gallic acid, small quantities of alumen and silex.

Medicinal Uses.—Tonic, astringent, or purgative, according to the extent of the dose administered. As a tonic, it is given in dyspepsia, hypochondriasis, and a weakened state of the bowels, combined with ginger, nutmeg, soda, magnesia, or bitters. From its astringent property, it is considered peculiarly eligible for exhibition in diarrhœa, any acrid matter being removed by its purgative effect before it acts as an astringent. Its purgative action is so mild that it may be given to very young children; in such cases it is generally combined with a small dose of calomel. It colours the urine in the space of twenty minutes after it is taken, and may be detected by means of an alkali. *Dose*, of the powder, as a tonic and astringent, gr. iij. to gr. v.; as a purgative, grs. xv. to ʒss.

Officinal Preparations.—Extract. Rhei—Inf. Rhei—Pil. Rhei Comp.—Tinct. Rhei Comp.

RHŒAS—PAPAVER RHŒAS (Red Poppy).—Polyand. [onog. Papaveraceæ, Juss. Indigenous.

The petals of the red poppy are used in medicine, in nsequence of the fine red colour which they yield. syrup is prepared from them, which is much emyed to colour other medicines.

)fficinal Preparation.—Syrup. Rhœados.

'CINI OLEUM—RICINUS COMMUNIS (Castor Oil

Plant).—Moncœc. Monadelph. Euphorbiaceæ, *Juss.* West Indies.

The seeds of this plant consist chiefly of vegetable albumen, with a quantity of oily matter intermixed. They afford, by expression or decoction, an oil, which under the name of castor oil, is much employed as a medicine in this country. The expressed, or cold-drawn oil is much the best.

The expressed oil contains an acrid matter, the source of which is much disputed; some suppose it to reside in the embryo, others in the perisperm, others in the cotyledon: this point of dispute is not yet settled. Two or three of the seeds will act as a violent cathartic. Castor oil is of a pale straw colour, transparent, viscid, and has scarcely any peculiar taste or smell; it has the general properties of an expressed oil, with the exception of its being soluble in alcohol. It contains three distinct acids—viz., the *ricinic*, *elaiodic*, and *margaritic*.

Medicinal Uses.—Castor oil is a mild and safe purgative, operating at the same time speedily. Whenever a mild, unirritating purge is indicated, this oil will be found the best. It is given in cases of dysentery, colic, muco-enteritis, and hæmorrhoids; it is also the safest purge during pregnancy. *Dose*, f ʒss. to f ʒ iss. It may be given in the form of emulsion, mixed with the yolk of egg, with gum, or reacted on by an alkali. It is also taken floating on peppermint water, or a purgative tincture, as that of senna. The oil sold in gelatinous capsules is generally mixed with croton oil.

Rosæ—Rosa Canina (Dog Rose, or Wild Brier). Rosa Centifolia (Hundred-leaved Rose). Rosa Gallica (Red Rose).

Icosand. Polygyn. Rosaceæ, *Juss.*

The *Rosa Canina* is indigenous. Its fruit has a pleasant, sweet, acidulous taste, depending on citric acid and sugar, which it contains.

Medicinal Uses.—It is cooling, but possesses no direct medicinal properties. It is used only in the preparation of the confection.

Officinal Preparation.—Conf. Rosæ Caninæ.

The petals of the *Rosa Centifolia* have no astringency, but are slightly laxative, and are employed from this quality in the preparation of a syrup, which is sometimes given to infants. Their distilled water is used as a pleasant vehicle for medicinal substances.

Officinal Preparations.—Aq. Rosæ—Syrup. Rosæ.

The petals of the *Rosa Gallica* have a slight degree of astringency, which is most considerable before they are expanded; hence they are collected in this state and dried. The infusion is used as a menstruum for medicinal substances; acidulated with sulphuric acid, it forms a pleasant astringent gargle.

Officinal Preparations.—Confect. Rosæ Gallicæ—Mel Rosæ—Infus. Rosæ Comp.

ROSMARINUS—ROSMARINUS OFFICINALIS (Rosemary).—Diand. Monogyn. Labiatæ, *Juss.* South of Europe.

This is a small evergreen shrub, a native of the South of Europe, now cultivated in our gardens. The flowering summits are officinal. The officinal parts have a fragrant odour, which resides in a volatile oil, which may be obtained by distillation.

Medicinal Uses.—It is a stimulant, and is added to liniments, as to soap liniment. Its medicinal virtues are but very lightly esteemed.

Officinal Preparations.—Lin. Saponis—Ol. Rosmarini—Spir. Rosmarini.

RUMEX—RUMEX ACETOSA (Common Sorrel).—Hexand. Trigyn. Polygoneæ, *Juss.* Indigenous.

The leaves of the common sorrel have a sour taste; they contain binoxalate of potash and tartaric acid. The expressed *juice may* be used to form an acidulous *drink in fevers.*

RUTA—RUTA GRAVEOLENS (Common Rue).—Decand. Monogyn. Rutaceæ, *Juss.* South of Europe.

This plant is the native of the South of Europe, but is now common in gardens in this country. When recent, this herb has a strong unpleasant smell and a bitter taste. By distillation it affords a pungent essential oil.

Medicinal Uses.—Stimulant, antispasmodic, and supposed to be emmenagogue. It has been given in hysteria and flatulent colic, and as an enema for children in convulsions. As an emmenagogue, it has been used in the form of infusion of the dried leaves, and the oil is sometimes combined with aloes. *Dose*, of the powdered leaves, gr. x. to gr. xx.

Officinal Preparation.—Confect. Rutæ.

SABADILLA—HELONIAS OFFICINALIS (Sabadilla).—Hexand. Trigyn. Melanthaceæ. Mexico.

The fruit of this plant is a capsule with three cells, each containing two or three seeds, which are blackish and angular. They are inodorous, but have an acrid, bitter taste. According to MM. Pelletier and Caventou, they contain fatty matter, wax, *supergallate of veratria*, gum, and woody fibre.

Medicinal Uses.—These seeds are merely used to obtain veratria, as directed in the Pharmacopœia.

SABINA — JUNIPERUS SABINA (Savine). — Dioecia Monadelph. Coniferæ. South of Europe.

The fresh tops and leaves of this shrub have a bitter, penetrating taste, a strong, disagreeable odour, and a considerable degree of acrimony. They afford a large quantity of oil, possessing the virtues of the plant. They impart their properties to alcohol and to water.

Medicinal Uses.—Stimulant, diuretic, and emmenagogue. From its direct action on the uterus, it is supposed to be capable of producing abortion; it enters into some empirical remedies that are used for *this* purpose. It has sometimes been found useful as an emmenagogue. Its dose is grs. x.—xx. of the

fresh leaves, or ɱiij.—x. of the essential oil. In the form of ointment, it is used to promote the discharge from blistered surfaces and from issues.

Officinal Preparation.—Ceratum Sabinæ.

SAGAPENUM.—The species of *Ferula* from which this substance is obtained is as yet uncertain. This gum-resin is brought to this country from Smyrna, Aleppo, and Alexandria. Dioscorides mentioned it as the juice of a ferula growing in Media; Willdenow supposes it to be the produce of the *ferula Persica*.

Sagapenum has an alliaceous odour, and a hot, acrid, bitterish taste, not unlike that of assafœtida. It is in small masses, of an olive or brownish colour, partially soluble in water and in alcohol; but totally dissolved by proof spirit. It is composed of gum, resin, supermalate of lime, volatile oil, and a peculiar matter, on which, perhaps, its properties depend.

Medicinal Uses.—The same as those of assafœtida; it is, however, much inferior in power to that substance. *Dose*, gr. x. to ʒj., made into pills.

Officinal Preparations.—Confect. Rutæ—Pil. Galb. Comp.—Sagapenum Preparatum.

SAGO—SAGUS RUMPHII (Sago Palm).—Moncœc. Hexand. Palmaceæ. East India Islands.

Sago is a form of starch obtained from the pith or medullary part of this plant. As much as 500 or 600 pounds of this substance have been obtained from one tree.

Medicinal Uses.—Demulcent and nutritive. Boiled in milk or water, it dissolves entirely; this solution, with sugar, and the addition of a little wine, forms a nutritious jelly, used in diarrhœa as a demulcent, and in convalescence as a nutritious article of diet, easy of digestion.

SAMBUCUS—SAMBUCUS NIGRA (Common Elder).—Pentand. Trigyn. Caprifoliaceæ. Indigenous.

The flowers, *which* are officinal, have a peculiar, *rather unpleasant odour*, stronger when fresh than

dried. They contain a small quantity of volatile oil.

Medicinal Uses.—The *flowers* are diaphoretic and laxative; but they are chiefly used in fomentations and in cooling ointments, and to afford their odour to water in distillation. The *berries* were formerly much used in febrile diseases, rheumatism, and gout; but they are now scarcely ever employed. The *bark* is an hydragogue purgative, and in large doses acts as an emetic.

Officinal Preparations.—Aqua Sambuci—Ung. Sambuci.

SAPO.—Potash and soda, when boiled with oils or fats, render them soluble in water, and form with them a kind of alkaline combination, called *soap*. *Hard soap* is made in the south of France with an inferior quality of olive oil and soda; in the north of Europe, where olive oil is not at hand, animal fat is used in place of it. *Soft soap* is made by the action of potass on oily or fatty matters. According to Chevreul, by saponifying 100 parts of hog's lard, mutton suet, or tallow, by 25 parts of pure potash, and 100 parts of water, *stearic*, *margaric*, and *oleic acids*, as well as *glycerine*, are produced. Sulphate of iron is used to give soap a bluish tinge. The variety generally used in medicine is called *Castile Soap*.

Medicinal Uses.—Soap is regarded as a laxative and lithontriptic; externally it is stimulant and detergent. Combined with rhubarb or some bitter, it has been recommended in jaundice and habitual costiveness. As a lithontriptic, it is used in the form of a pill, with the dried carbonate of soda. In solution, it has been recommended to counteract the effects of metallic poisons. It is frequently used in pharmacy to give consistence to powders when they are to be formed *into* pills. As an external application, soap is efficaciously employed in frictions to sprains and bruises. *Dose*, gr. v. to ℈j.

Officinal Preparations.—Ceratum Hydrarg. Comp.—Cerat. Saponis—Empl. Saponis—Enema Colocynthid.—Lin. Saponis—Lin. Terebinth.—Pil. Cambog. Comp.—Pil. Rhei Comp.—Pil. Saponis Comp.—Pil. Scillæ Comp.—Ung. Sulphur. Comp.

SARZA—SMILAX OFFICINALIS(Sarsaparilla).—Dioecia Hexand. Asparagineæ, *Juss.* South America, Virginia.

The plant which affords sarsaparilla was long named Smilax Sarsaparilla, but is now designated as above. This root is in long slender twigs, which for pharmaceutical purposes are split and cut into small pieces; internally it is white, externally it is covered with a brownish bark; it is nearly inodorous, but has a slight bitterness, which is extracted by water, as is also a quantity of starch. It contains starch, lignin, extractive matter, resin, and, according to some chemists, *Smilacine, Parillina,* and *Parillinic acid:* Pfaff found an extractive matter in it resembling *cinchonia. Smilacine* occurs in acicular crystals, is slightly soluble, has a bitter taste, and does not act on litmus paper. Formula $C_5H_5O_2=57$.

Medicinal Uses.—Sarsaparilla is a powerful alterative and restorative. It has long enjoyed the reputation of being a powerful medicine in syphilis. It is generally given in the secondary forms of this disease, either with nitric acid, iodide of potassium, or bichloride of mercury. It has also been recommended in scrofula, elephantiasis, and chronic rheumatism. From experiments made upon himself, M. Pallota considers that *parillina* is a powerful debilitating medicine. *Dose,* of the simple decoction, f℥iv. to f℥viij. three or four times a day; of the compound decoction, f℥iv. to f℥vj. three times a day; of the extract, ℈ss. to ℈j.

Officinal Preparations.—Decoct. Sarzæ—Decoct. Sarzæ Comp.—Extract. Sarzæ.

SASSAFRAS—LAURUS SASSAFRAS (Sassafras).—*Enneand. Monog. Laurineæ, Juss.* America.

Sassafras has a moderately fragrant smell, and sweetish aromatic taste. By distillation it yields volatile oil. By infusion or decoction it yields it flavour and part of its taste to water; alcohol extract all its virtues. The root only is officinal; the bark the root is the most active part.

Medicinal Uses.—It is slightly stimulant and diaphoretic. Combined with sarsaparilla, or given alone in the form of infusion, it has been employed in secondary syphilis, cutaneous diseases, and chronic rheumatism.

Officinal Preparations.—Decoct. Sarzæ Comp.—O Sassafras.

SCAMMONIUM — CONVOLVULUS SCAMMONIA (Scammony).—Pentand. Monogyn. Convolvulaceæ, *Jus* Syria.

Scammony is obtained by cutting the root of th plant obliquely a few inches above the ground; milky juice exudes, which is collected and inspissate by exposure to the sun and air.

Good Aleppo Scammony is light, friable, and breal with a regular, smooth, faintly-shining fracture. It odour somewhat resembles that of old ewe-milk chees and the stronger this odour is, the better the scammony. Its taste is bitterish and slightly acrid. Th colour is a dark grey, and if good it lathers or turn to a dirty white when it is rubbed with a moist finge Alcohol takes up sixth-tenths of scammony; thi is pure resin, which may be precipitated from it alcoholic solution by water. Scammony is compose of—

	Aleppo.	Smyrna.
Resin	60	29
Gum	03	8
Extractive matter	02	5
Waste	35	50

Medicinal Uses.—It is a drastic cathartic and an *thelmintic.* It is given in the torpid state of th

intestines, in leucophlegmatic, hypochondriacal, and maniacal subjects; also in hydrocephalus, worm cases, and the slimy state of the bowels to which children are liable. Combined with bitartrate of potash, it has been used in dropsical cases. In consequence of its tendency to gripe, it is generally combined with some aromatic, or a drop of some essential oil. *Dose*, for a child, gr. iij. to gr. v.; for an adult, gr. x. to gr. xv.

Officinal Preparations. — Conf. Scammon. — Extract. Colocynth. Comp.—Pulv. Scammon. Comp.

SCILLA—SCILLA MARITIMA (Squill).—Hexand. Monogyn. Liliaceæ, *Linn.*, *Juss.*

Squill is the bulbous root of a plant which grows on the sandy shores of Spain, Italy, Sicily, Syria, and Barbary. There are two varieties of officinal squill, one with a white bulb, the other reddish; they are both used in medicine, and do not differ in their medicinal properties. Squill-bulb is spear-shaped, and consists of concentric lamellæ, easily separable, each covered with a thin membrane of a white or purplish colour. It is nearly inodorous; its taste is bitter and acrid, and it is capable of inflaming the skin; its acrimony is diminished by drying. It is composed of gum, *scillitina*, tannin, saccharine matter, woody fibre, and citrate of lime.

Scillitine, or *scillitina*, is the bitter, adhesive matter of the squill. It is obtained by treating the thick juice of this plant with alcohol, and the alcoholic solution with acetate of lead. It is white, transparent, of resinous fracture, and a bitter taste. It is soluble alcohol. Dried squill-bulb contains thirty-five per cent. of this substance.

Medicinal Uses.—In small doses, it is a stimulating expectorant and diuretic; in larger doses, it acts as emetic and purgative. As an expectorant, it is given in chronic catarrh, chronic bronchitis, and the advanced stages of whooping cough. As a diuretic, *given in dropsies*, combined with mercurials and

digitalis. It should not be given in dropsical cases complicated with pneumonic or renal affections. Some recommend squill to be given as a diuretic until it induces nausea; it is preferable, however, that it should not produce this effect. As a diuretic, it should always be given in substance. In the form of oxymel, it has been given in small and repeated doses to children labouring under whooping cough, so as to induce vomiting. *Dose*, of the powder, gr. j. to gr. v.; of the tincture, f ℥ss. to f ℥j.; of the oxymel. f ℥j. to f ℥ij.

Officinal Preparations. — Acet. Scillæ — Oxymel Scillæ—Pil. Scillæ Comp.—Tinct. Scillæ.

SCOPARIUS—CYTICUS SCOPARIUS (Common Broom). —Diadelph. Decand. Leguminosæ, *Juss.* Indigenous.

The tops of the young branches of the broom have a bitter taste, which is imparted both to water and alcohol.

Medicinal Uses.—A decoction of this substance is used as a popular remedy in dropsy, and sometimes with success. It acts both as a diuretic and cathartic. *Dose*, of the decoction, f ℥j. to f ℥ij. three times a day.

Officinal Preparation.—Decoct. Scoparii Comp.

SENEGA—POLYGALA SENEGA (Senega, Rattlesnake Root).—Diadelph. Octand. Polygalæa, *Juss.* North America.

This root is in articulated shoots or joints, like those of the tail of the rattlesnake: hence its name. It is inodorous; its taste is at first sweetish and nauseous, but after being chewed for a short time becomes hot and pungent. From six ounces of the root, Peschier separated 100 grains of a peculiar alkaline principle, which he named *polygalina;* it is united with an acid which he denominated *polygalinic.* This salt he supposes to be the active matter of senega root.

Medicinal Uses.—Stimulating, expectorant, and *diuretic;* in large doses, emetic and cathartic. It in-

creases the natural excretions, and especially that of the urine; it frequently causes ptyalism. It is an excellent remedy for any case in which the lungs are loaded with mucus, and the pulse is depressed. It is used also in some forms of dropsy. It has been found efficacious in rheumatic and scrofulous ophthalmia. A decoction of it has been used, in America, in cases of croup, given in divided doses till it vomit or purge. *Dose,* of the powder, gr. x. to gr. xv.; of the decoction, f ℥ss. to f ℥j.

Officinal Preparation.—Decoct. Senegæ.

SENNA—CASSIA LANCEOLATA and C. OBOVATA (Senna).—Decand. Monog. Leguminosæ, *Juss.* Egypt, Arabia.

Senna is considered to be the product of several species of cassia, and of various other plants. Those from which it is chiefly obtained are, the C. Lanceolata, C. Acutifolia, C. Obovata, and C. Elongata.

Dried senna leaves are of a yellowish-green colour, have a faint smell, and a bitter taste. The active principle of senna, according to the experiments of MM. Lassaigne and Fenuelle, is a saline substance, which they have named *cathartine.* It is uncrystallizable, and, as usually obtained, of a reddish-yellow colour, deliquescent, soluble in alcohol and water, but insoluble in ether. The activity of senna is much impaired by boiling.

Senna is frequently adulterated with the leaves of the *cynanchum oleifolium,* known in Egypt by the name of argel or arguel. It may, however, be easily detected by attending to the following differences:—1. The leaf of argel is an inch or fourteen lines long, while that of the senna *acutifolia* and senna *obtusifolia* never exceeds nine lines. 2. The leaf of argel has a straight side; and lateral nerves are not seen on the under disk, while those of senna are conspicuous. 3. The leaf of argel is regular at its base, the two sides terminating at the same point on the petiole; but the

senna leaflets are oblique, one of the sides being larger, and produced lower on the petiole, than the other.

Medicinal Uses.—Senna is much employed as a cathartic, having considerable activity, but producing no unpleasant effects. Its tendency to gripe may be in a great measure obviated by combining aromatics or neutral salts with it. Its operation is promoted by nauseants, and, according to some authors, by bitters. It is frequently combined with manna and tamarinds; its taste being in a great measure disguised by manna, it is often given to children with this substance. *Dose*, of the powder, ℈ss. to ʒj.; of the infusion, f ʒj. to f ʒij.; of the tincture, f ʒij. to f ʒs.

Officinal Preparations.—Confec. Sennæ—Inf. Sennæ Comp.—Syrupus Sennæ—Tinct. Sennæ Comp.

SERPENTARIA—ARISTOLOCHIA SERPENTARIA (Virginian Snakeroot).—Gynand. Hexand. Aristolochiæ, *Juss.* Virginia, Carolina.

Serpentary root consists of a number of small fibres, issuing from one stem, of a greyish-brown colour; it has a slightly aromatic smell, and a warm, bitterish taste. It yields its virtues to water and to alcohol. Its active matter resembles *quassine*. It also contains a volatile oil and camphor.

Medicinal Uses.—It is a stimulating diaphoretic and tonic, used in typhoid fevers to promote diaphoresis, and to support the powers of the system. It is seldom prescribed, its powers as a medicine in those cases being much inferior to cinchona. In consequence of its stimulating action, it is contra-indicated where there is an inflammatory diathesis. It occasionally enters into the bitter infusions and tinctures used in dyspepsia. *Dose*, of the powder, gr. x. to ʒj.; of the infusion, f ʒj. to f ʒiss.; of the tincture, f ʒij. to f ʒiij.

Officinal Preparations.—Inf. Serpent.—Tinct. Cinchon. Comp.—Tinct. Serpentariæ.

SEVUM —*Suet*, the fat from the OVIS ARIES (Sheep).

Suet is the fat of the sheep, taken chiefly from about the kidneys. It contains a large proportion of stearine, and requires a higher temperature (103°) to melt it than any other animal fat. By its saponification a peculiar acid called *Hircic* is formed. In medicine it is chiefly employed in the preparation of plasters and ointments. According to Chevreul, it consists of stearine and oleine, with hircine and a little margarine.

Officinal Preparations. — Emplast. Ceræ — Ung. Elemi—Ung. Hydrarg. Fort. et Mitius—Ung. Picis Liquid.

SIMARUBA – SIMARUBA OFFICINALIS (Simaruba).—Decand. Monogyn. Rutaceæ, *Juss.* South America.

The bark of the root of this tree, which is the officinal part, is in long pieces, of a fibrous texture, and yellowish colour; destitute of odour, and possessing a strong bitter taste. Water and alcohol dissolve its active principle, which is said to be *quassine.*

Medicinal Uses.—Tonic, given in those cases where mild tonics are indicated. *Dose,* of the infusion, f ʒj. to f ʒiss.

Officinal Preparation.—Inf. Simarubæ.

SINAPIS—SINAPIS NIGRA (Black Mustard).—Tetradynam. Siliquos. Cruciferæ, *Juss.* Indigenous.

The seeds of black mustard have a considerable degree of acrimony and pungency, that depends on a peculiar substance, which on contact with water is decomposed, and forms an acrid principle. It contains much sulphur. Mustard seeds contain also a bland fixed oil, which is purgative in large doses.

Medicinal Uses.—Stimulant and emetic. It is used as a stimulant in dyspepsia, chronic rheumatism, and amenorrhœa. As an emetic, it has been given in cases of paralysis, and in poisoning, where other emetics are not at hand. Externally it is used in the form of sinapisms to produce a *derivative effect.* Vinegar should not be added to sinapisms, as it diminishes their *effects.*

Officinal Preparations.—Cataplasma Sinapis.

Sodæ Phosphas ($2NaO, PO_5 HO = 145 + 24$ Aq. = 361).—*Phosphate of Soda* is commonly prepared by adding to an acidulous phosphate of lime as much carbonate of soda in solution as will fully saturate the acid. The carbonate of lime which precipitates being separated by filtration, the liquid is evaporated so as to crystallize the phosphate of soda. There should be a slight excess of alkali present, otherwise the crystals will not be large and regular.

The crystals of phosphate of soda are rhomboidal prisms of different shapes, efflorescent, soluble in three parts of cold and 1½ of hot water. They are capable of being fused into an opaque white glass, which may be again dissolved and crystallized.

Medicinal Uses.—As its taste is simply saline, without anything disagreeable, it is used as a purgative, chiefly in broth, in which it is not distinguishable from common salt. *Dose*, for an adult, from ℥j. to ℥iss.

Sodii Chloridum (Na Cl = 60.)—*Chloride of sodium* (common salt) may be formed by burning sodium in chlorine, by heating sodium in hydrochloric acid gas, and by neutralizing soda with hydrochloric acid. As a mineral under the name of *rock salt*, it is the chief ingredient of sea water, and is contained in many saline springs. Rock salt generally contains small quantities of sulphates of magnesia and lime, and some chloride of magnesium. These earths may be precipitated as carbonates by boiling a solution of salt for a few minutes with an excess of carbonate of soda, filtering the liquid, and neutralizing with hydrochloric acid. If evaporated rapidly, its crystals are hollow four-sided prisms: if allowed to evaporate spontaneously, its crystals are regular cubes.

Chloride of sodium has an agreeable saline taste. It is permanent in a dry atmosphere, but deliquesces in a moist. It requires twice and a half its weight of

ater at 60° for solution, and its solubility is not in-eased by heat; it is insoluble in pure alcohol. Its ystals do not contain any water of crystallization, it decrepitate when heated, owing to the expansion the water mechanically confined within them.

Medicinal Uses.—This salt is tonic, in small quan-ities; in larger doses, it is emetic and purgative. It considered to promote digestion. It is also said to minish the tendency to the formation of worms in e intestines, and to promote their removal if present. he excessive use of salt or salt food is liable to pro-uce scurvy, and, according to some authorities, *molli-es ossium*. A strong solution of common salt acts as emetic.

SPIGELIA—SPIGELIA MARILANDICA (Indian Pink). ntand. Monogyn. Gentianæ, *Juss.* North America. This plant has a faint smell, and a sweetish, rather tter, but not unpleasant taste. The leaves contain e same principles as the root, but the latter, being re active, is officinal.

Medicinal Uses.—Anthelmintic, but scarcely ever d. When in the recent state, and given in small es, it occasionally produces giddiness, dimness of n, and even convulsions; in its dried state, how-, it does not produce any of those effects.

Medicinal Preparation.—Stanni Protochloridum, used Pharmacopœia test.

STANNUM.—Tin is reduced to a powder, consisting of rounded particles, by heating it nearly to its g point, and agitating it briskly.

Medicinal Uses.—Either this powder or the metal in has been used as an anthelmintic—its action, ng to some, being merely mechanical, while ssert that it causes hydrogen to be evolved in stines, which proves noxious to the worm. Its is said to be increased by combining it with which causes the formation of hydrosulphuric *se, from* ℥j. *to* ℥iss.

STAPHISAGRIA—DELPHINIUM STAPHISAGRIA (Staves-acre).—Polynd. Trigyn. Ranunculaceæ, *Juss.* South of Europe.

Stavesacre seeds are large and black, and have an acrid taste. They contain an alkaloid, named *delphia*, or *delphinia*. This alkaloid is solid, white, pulverulent, but crystalline, fusible like wax, very bitter and acrid, almost insoluble in water, very soluble in ether and alcohol, and capable of forming salts with most of the acids.

Medicinal Uses.—Stavesacre was at one time used as an emetic and cathartic, but its operation is so violent that it is now never given internally. Externally, it is used as an application to cutaneous eruptions, and to destroy *pediculi*.

STRAMONII FOLIA ET SEMINA—DATURA STRAMONIUM (Thorn-apple).—Pentand. Monogyn. Solaneæ, *Juss.* Indigenous.

Every part of this plant possesses medicinal properties, but the leaves and seeds only are officinal. Geiger and Hesse have obtained a colourless, crystalline alkaloid, of an acrid taste, which may be called *daturia*. By the destructive distillation of the thorn-apple, an empyreumatic oil, similar to that of hyoscyamus, is obtained.

Medicinal Uses.—Narcotic and anodyne. It has been employed in mania, epilepsy, hysteria, sciatica, and chronic rheumatism. The herb, smoked like tobacco, has been found to afford much relief in spasmodic asthma. According to the late Dr. Marcet, this medicine acts as a powerful anodyne, has rather a relaxing than an astringent effect on the bowels, and but slightly affects the pulse. It dilates the pupil, but in a much less degree than belladonna. Externally applied, this substance has been used in the form *of fomentation* or poultice to painful tumours. *Dose, of the* powdered leaves, gr. ij. to gr. v.; of the *extract*, gr. ½ to gr. iij.

Officinal Preparation.—Extract. Stramonii.

STYRAX—STYRAX OFFICINALE (Storax).—Decand. Monogyn. Styraceæ. Turkey in Asia.

The resinous juice afforded by the storax tree, from ncisions made in the bark of the stem, is, in the state n which it is imported, very impure, from the inter- nixture of sawdust, and sometimes of earthy matter. :t is in masses, soft, slightly unctuous, having a strong ragrant odour, and a bitterish pungent taste. It onsists principally of resin, with a small portion of benzoic acid.

Medicinal Uses.—It is said to possess similar pro- perties to benzoin; it is, however, very rarely em- ployed.

SUCCINUM.—*Amber* is a hard, brittle, bituminous substance, sometimes perfectly transparent, but mostly semi-transparent or opaque, and of a glossy surface. By distillation it yields a small quantity of water, a little acetic acid, oil, and succinic acid. The il rises at first colourless; but as the heat increases, becomes brown, thick, and empyreumatic. This oil ay be rectified by successive distillations, or it may obtained very light and limpid at once, if it be put o a glass alembic with water, and distilled at a heat t exceeding 212°. In order to retain it limpid, it st be kept in stone bottles, for it becomes changed the action of light.

edicinal Uses.—This oil has been celebrated as an spasmodic in hysteria, epilepsy, tetanus, amenor- , and pertussis. It is now discarded from prac- or is used only as an external application in ysis, chronic rheumatism, and pertussis. *Dose*, o ♏x.

inal Preparation.—Tinct. Ammon. Comp.

PHUR.—Common sulphur is purified by sublima- and if this process be conducted slowly, the r collects in the receiver in small crystalline *called "flowers of sulphur."* In this state,

however, it is not pure, for the oxygen of the air within the apparatus combines with a portion of the sulphur, and forms sulphurous acid. By washing the sulphur, any adhering acid is removed. Sulphur obstinately retains a portion of hydrogen, from which it is not completely separated either by fusion or sublimation, in this respect resembling charcoal. For an account of its properties, *vide* p. 148.

Medicinal Uses.—It is laxative and diaphoretic. As a laxative, from the mildness and permanency of its action, it is frequently given in hæmorrhoidal affections; in these cases it is generally combined with magnesia, which promotes its purgative effects. In consequence of its diaphoretic action, it is useful in chronic rheumatism, in catarrh, and in some cutaneous affections. When given internally, it passes off by the skin; hence it is administered internally, as well as applied externally, in psora, in which disease it may be regarded as a specific. It is supposed that the sulphur, in passing off by the skin in the form of hydrosulphuric acid, comes in contact with the insect (*acarus scabiei* of Fabricius) which is the supposed cause of the itch, and destroys it. Sulphur is best given in the form of electuary. *Dose*, ʒj. to ʒiij.

TABACUM—NICOTIANA TABACUM (Tobacco Plant). Pentand. Monogyn. Solaneæ, *Juss.* America.

This plant, though cultivated in this country, is usually imported from America. Its leaves are of a large size and of a light-green colour, which they in a great measure retain when dried. Their smell is fetid, and their taste extremely bitter and acrid. Vauquelin analysed tobacco some time ago, and procured an acrid volatile principle, which he called *nicotine*. Hermbstädt afterwards examined it, found Vauquelin's principle to be impure, and thought he found the *active* principle in a white, foliated, crystallized substance, which he named *nicotianine*. This substance has since been proved to be the essential oil of tobacco,

which is solid at ordinary temperatures. MM. Posselt and Reimarus have detected an active matter which is fluid at 29° F., volatile, extremely acrid, alkaline, and capable of forming crystallizable salts with some of the acids. The active qualities of tobacco are imparted both to water and to alcohol.

Medicinal Uses.—Tobacco is a narcotic, sedative, emetic, diuretic, cathartic, and errhine. Tobacco enema has been employed in cases of strangulated hernia, ileus, obstinate constipation, colica pictonum, dysentery, tetanus, and ischuria. But it requires very great caution, as it may easily cause death by paralysing the heart. It was formerly given internally as an emetic and diuretic, but it is scarcely ever used with such intention in modern practice. Smoking tobacco has been recommended in cases of tooth-ache, to relieve the pain, and in cases of spasmodic asthma, in order to shorten the paroxysm. The external application of a strong infusion of tobacco, or of a cataplasm of the moistened leaves themselves, is sometimes employed as a local stimulant in porrigo, tinea capitis, and other cutaneous affections. Its use, even in this form, is attended with danger.

Tobacco is used as a sternutatory, and is the basis of all the kinds of *snuff* generally used. Its immoderate use in this way has been said to weaken the vision, produce lethargy, and cause a tendency to apoplexy. After the use of it has become habitual, it cannot be relinquished without some risk, arising from the suspension of the artificial discharge it produces.

Officinal Preparation.— Enema Tabaci.

TAMARINDUS — TAMARINDUS INDICA (Tamarind Tree).—Monadelph. Triand. Leguminosæ, *Juss.* East and West Indies.

The pod of this tree includes several large hard seeds, with a brown viscid pulp, very acid. In the West Indies, the pods are gathered in June, July, and *August, when fully* ripe; and the fruit, being freed

from the shelly fragments, is placed in layers in a cask, and boiling syrup poured over it till the cask is filled; the syrup pervades every part quite down to the bottom, and when cool, the cask is headed for sale.

Vauquelin found sixteen ounces of this prepared pulp to contain, besides the sugar mixed with it, an ounce and a half of citric acid, two drachms of tartaric acid, half an ounce of bitartrate of potash, half a drachm of malic acid, jelly, mucilage, and fibrous matter. When tamarinds are good, they are free from any degree of mustiness; the seeds are hard, flat, and clean; the strings tough and entire; and a clean knife thrust into them should not receive a coating of copper.

Medicinal Uses.—Tamarind pulp is refrigerant and gently laxative. The simple infusion of the pulp in water forms a very grateful refrigerant drink in febrile diseases. As a laxative medicine, tamarinds are rarely used alone, but are combined with other substances, as in the confection of senna. The salts of potass are incompatible in mixtures with this fruit. *Dose*, ʒss. to ʒij.

Officinal Preparations.—Confect. Cassiæ—Confect. Sennæ.

TARAXACUM—LEONTODON TARAXACUM (Dandelion). —Syngenes. Æqualis. Compositæ Chicoraceæ, *Juss.* Indigenous.

The root, which is the officinal part, is fusiform, internally white, and covered externally with brown cuticle. The recent, full-grown root only should be used, and it should be raised in autumn. The active principles of dandelion are, *extractive, gluten*, a *bitter principle*, and *tartaric acid*, either free or in a state of a supertartrate.

Medicinal Uses.—Aperient, deobstruent, and diuretic. It has been long used on the Continent as a remedy in jaundice, dropsy, pulmonic tubercles, hepatic obstructions, and some cutaneous diseases. According to

Bergius, and more lately, Drs. W. Philip and Pemberton, this medicine has succeeded in removing dropsy, biliary obstructions, and induration of the liver, when other remedies have failed. Half a drachm of the extract may be given twice or three times a day, diffused in cinnamon water. The juice expressed and preserved by adding alcohol, or an infusion made by steeping the bruised root in cold water, are the best forms of administration. The extract is nearly inert.

Officinal Preparation.—Extract. Taraxaci.

TEREBINTHINA CANADENSIS — PINUS BALSAMEA (Balm of Gilead Fir).—Moncœc. Monadelph. Coniferæ. North America.

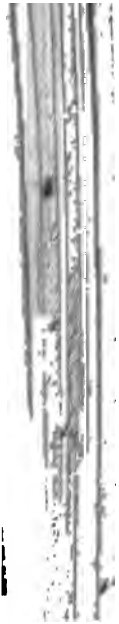
Canadian Balsam is the resinous juice which exudes from incisions made into the body of this tree. It is of a light yellow colour, tenacious, and, like the other turpentines, highly inflammable. By age it becomes thicker; its odour is agreeable and its taste pungent. The term balsam, as applied to this substance, is incorrect, as it does not contain benzoic acid. It is the purest of the turpentines.

Medicinal Uses.—Its medicinal virtues resemble those of copaiba, and it may be given in similar cases to those in which that medicine is employed. *Dose*, from twenty to forty drops.

TEREBINTHINA CHIA — PISTACHIA TEREBINTHUS (Chio, or Cyprus Turpentine-Tree)—Diœc. Pentand. Terebinthaceæ, *Juss.* South of Europe.

This turpentine is gathered chiefly in Chios, by making incisions in the bark of the trunk of the tree, in the month of July. Chio turpentine has a fragrant odour, and a moderately warm taste; it has the consistence of thick honey; is clear, transparent, and tenacious. Its powers are the same as the other turpentines; but, not being easily procured, it is scarcely ever employed.

TEREBINTHINA VULGARIS—PINUS SYLVESTRIS (*Wild Pine, or Scotch Fir*).—Moncœc. Monadelph. Coniferæ.



The wild pine, or Scotch fir, so nam
growing wild on the Scotch mountains, i
most of the northern parts of Europe. T
its perfection when between seventy and
old; but it yields turpentine at the age
May, the outer bark is stripped off to
six inches near the foot of the tree, a
three inches square and an inch deep, is
sharp instrument. The resinous juice s
exude in transparent drops, which fall int
viously dug at the foot of the tree. Fr
are successively made till September, w
checks the further exudation. The turp
flows into the holes dug at the bottom o
called *pure dipping*. Part of the juice
the wounds, and is called *galipot* in Pr
barras in Guienne. A healthy tree wil
six to twelve pounds of turpentine annua
or even a hundred years. By distilling
pentine with water in a common still, th
pentine is obtained. When rectified, it is
or *essential oil*. The average proportio
cured in this way is, 60 lbs. of oil from
good turpentine. The residuum, after thi
is the common *yellow resin*.

Oil of turpentine has a strong, penetrat
odour, and a hot, pungent, bitterish taste
fectly limpid and colourless, very light,

hæmorrhagica, and in chronic rheumatism. Dr. Copland recommends it in the hæmorrhagiæ, especially in atonic epistaxis and hæmoptysis. It has been found useful in epilepsy, hysteria, and in infantile convulsions, arising from a disordered state of the alimentary canal. It is a powerful remedy in the advanced stages of fevers, where the abdomen is tympanitic, and there is great prostration of the vital powers. It seems to unload the gorged vessels of the mucous membrane, it removes the tympanitis, opens the bowels, and, finally, has a tranquillizing effect on the nervous system. Mr. Carmichael has shown that oil of turpentine is capable of checking the progress of iritis, and producing a cure. Dr. Jacob admits this, but prefers mercury. Turpentine has also been employed in sciatica, lumbago, and neuralgic diseases. Dr. Mason Good recommends a dose of six drachms of this oil as the best aperient that can be employed in gout. It has been used in ovarian dropsy, and other forms of dropsy, not even excepting hydrocephalus. Its reputation as an anthelmintic in cases of tinea is now well established. The use of this oil should be immediately discontinued, if an eruption resembling eczema appears on the skin. As an enema, oil of turpentine is used in cases of scarides, chronic tympanitis, obstinate costiveness, nd colic.

Used externally, it forms an excellent addition to e embrocations employed in acute rheumatism, ıises, and paralysis of the extremities. It is also ployed as a styptic to bleeding wounds. It is an ellent application to scalds and burns. As a dis- ient, it is applied to indolent tumours. Warm ıentine is occasionally used as a counter-irritant. ıf turpentine may be diffused in water by means monds, mucilage, or yolk of egg and sugar. Copland recommends the addition of tincture of ıum, for correcting the nauseating and unpleasant *which it frequently produces.* Dose, as a

Croton oil is obtained by expression fr
of this plant. It is of a pale reddish-y
its taste is hot and acrid, and it leaves a
sensation in the mouth and fauces, wh
several hours. This oil is soluble in eth
turpentine. Alcohol takes up two parts
and the solution possesses the acrimony
thartic properties of the oil, whilst the
portion is devoid of activity. According
Caventou, and Brandes, croton oil cont
acid, a volatile substance, solidifying
yielding vapours at about 32°.

Medicinal Uses.—Croton oil is a pow
cathartic, operating on the bowels very
has been given with much benefit in m
sions, obstinate constipation, apoplexy, a
litis, where it is of great importance to
and speedy evacuation of the bowels.
used with great caution, as it occasions
violent hypercatharsis. From the small
dose in which it acts, it can be given to
state of insensibility, or who obstinately

Tormentil root has a slightly aromatic odour, and an austere styptic taste. It owes its astringency to tannin, of which it contains a larger proportion than any other vegetable, except galls or catechu. It yields its active matter to boiling water.

Medicinal Uses.—Under the form of decoction it has been used in diarrhœa; and in substance, in doses of from ʒss. to ʒj., it has been employed in intermittent fever. Its decoction has been recommended as a gargle in affections of the throat and in sponginess of the gums. This medicine, is, however, very rarely used. *Dose*, from ʒss. to ʒj.

Officinal Preparations.—Pulv. Cretæ Comp.—Pulv. Cretæ Comp. c. Opio.

TOXICODENDRON—RHUS TOXICODENDRON (Poison Oak, or Sumach).—Pentand. Trigyn. Terebinthaceæ, *Juss.* North America.

This plant has so much acrimony that the touching of the leaves, or rubbing them on the skin, causes vesication. The dried leaves are inodorus, and have a mawkish subacrid taste. Their virtues are completely extracted by water, and partially by alcohol. According to Van Mons, this plant disengages an acrid matter, in combination with carburetted hydrogen, at night.

Medicinal Uses.—The leaves are stimulant and narcotic. Given in doses of from half a grain to three or four grains thrice a day, this medicine has been found efficacious in paralysis. It excites a sense of heat, and pricking, and irregular twitchings in the affected part, in the same manner as strychnia does.

TRAGACANTHA — ASTRAGALUS VERUS. — (Tragacanth).—Diadelph. Decand. Leguminosæ, *Juss.* Persia and Asia Minor.

Tragacanth gum exudes in summer, more or less copiously in proportion to the warmth of the weather, in tortuous filaments, which are allowed to dry on the plant *before being* collected. It is in wrinkled pieces,

semi-transparent and brittle, and is devoid and taste. It differs from the pure gums in r perfectly soluble in cold water. It is greatly to all the gums in communicating viscidity (Its peculiarities arise from its containing a called *bassorin*. Its mucilage differs from tha acacia in being precipitated by acetate of l phate of copper, nitrate of mercury, and ch tin; and not by silicated potash, nor by th phate of iron.

Medicinal Uses.—Tragacanth has similar to the gum acacia. It is, however, better for allaying tickling cough, and sheathing th owing to its greater viscidity. It is chiefly e for pharmaceutical purposes.

TUSSILAGO — TUSSILAGO FARFARA (Colts Syngenes. Superfl. Compos. Corymbif., *Jus* genous.

Coltsfoot leaves are more frequently used flowers; they should be gathered when they expanded, and before they have attained their magnitude. The leaves when dried are in and have a rough, mucilaginous taste.

Medicinal Uses.—The leaves and flowers, in milk, are used as a popular remedy in cata efficacy in which affection is very doubtfu drug has been wisely omitted from the prese macopœia.

VALERIANA—VALERIANA OFFICINALIS (*S* —(Wild Valerian).—Triand. Monogyn. Va *Juss.* Indigenous.

The root of this plant, which is the offici consists of slender fibres twisted and attache head, of a light brown colour, having a str unpleasant smell, and a warm, bitter taste, t *and taste* being much stronger in the wild tha *cultivated* valerian. Its properties seem to de a *liquid* greenish-white coloured volatile o

m its odour and taste seems to contain much cam-
r. Its specific gravity at 77° F. is 0·9340; when
osed to the light, it becomes yellow. A small
tion of nitric acid converts it into resin, and a
er quantity into oxalic acid.

Medicinal Uses.—Tonic, antispasmodic, and emme-
ogue. It is frequently employed in hysteria,
rea, and epilepsy, where these affections are not
nded with marked organic derangement. It is
en with advantage in hemicrania. It is a useful
dicine in hypochondriasis; and is regarded as a
icious adjunct to cinchona in intermittents. *Dose*,
the powdered root, from ℈j to ʒj., three or four
es a day.

Officinal Preparations.— Inf. Valerian.—Tinct. Va-
ian.—Tinct. Valerian. Comp.

VERATRUM—VERATRUM ALBUM (White Hellebore).
Polygam. Moncec. Colchicaceæ, *De Cand.* South
Europe.

Although the root only is officinal, yet every part of
plant is extremely acrid and poisonous. The
ent root has a strong, disagreeable odour, and a
terish, very acrid taste. The dry root, as found in
shops, is sliced, the thick part transversely, and
fibrous longitudinally. When very light and
ngy, the roots must be rejected. White hellebore
ntains a fatty matter composed of *elaine, stearine,*
d *ammonia, supergallate of veratria, a yellow colour-*
matter, starch, gum, and *lignin.*

Medicinal Uses.—White hellebore is a violent drastic
hartic, emetic, and errhine. Although its use has
n attended with most violent effects, yet it is re-
mmended in cases of mania, epilepsy, lepra, and
minate herpetic eruptions. This is, however, ex-
mely injudicious. As an errhine, it has b
yed in amaurosis, and in lethargic cases.
of decoction, as a wash, or mixed with l
ment, it is used in scabies, and in herpetic

Officinal Preparations.—Decoct. Veratri—Vin. Veratri—Ung. Sulph. Comp.—Ung. Veratri.

ULMUS — ULMUS CAMPESTRIS (Elm). — Pentand. Digyn. Urticeæ, *Juss.* Indigenous.

The inner bark of the younger branches, which is of a yellowish colour, is the part officinally used. It has a bitterish taste, is inodorous, and contains a peculiar principle called *ulmin.*

Medicinal Uses.—This bark operates as a diuretic. Some practitioners strongly recommend it in cutaneous eruptions, especially in lepra. Dr. Willan thinks it is of little use.

Officinal Preparation.—Decoct. Ulmi.

UVÆ—VITIS VINIFERA (Common Vine).—Pentand. Monogyn. Vitaceæ.

The vine is a native of Armenia, Georgia, and the Levant; but it is now cultivated in most of the temperate regions of the earth.

Raisins are made from the varieties named the *black-raisin grape* and the *white-raisin grape.* They are cured in two ways—either by cutting the stalk of the bunches half through, when the grapes are nearly ripe, and leaving them suspended on the vine till their watery part be evaporated, and the sun dries them; or by gathering the grapes when they are ripe, and dipping them in a ley made of the ashes of the burnt tendrils, after which they are exposed to the sun to dry. Those prepared by the first method are the best. *Raisins* differ from grapes, in containing a larger quantity of sugar; but the sugar of grapes differs from common sugar in containing one atom more water in proportion to the carbon—*vide* p. 177.

Medicinal Uses.—Eaten in large quantities, raisins are laxative, but are apt to cause flatulence. In medicine they are merely used as adjuncts to some officinal preparations.

Officinal Preparations.—Decoct. Hordei Comp.—Tinct. Cardam. Comp.—Tinct. Sennæ Comp.

UVA URSI—ARCTOSTAPHYLOS UVA URSI (Bearberry).—Decand. Monogyn. Ericineæ, *Juss.* Europe, America.

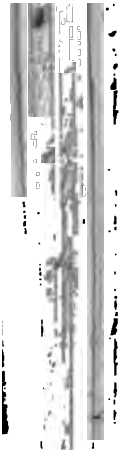
The leaves of this shrubby plant are small, of a dark-green colour, and have a bitter astringent taste. They contain a large proportion of *tannin*, some *mucus*, *bitter extractive*, *gallic acid*, *resin*, *lime*, and an *oxygenizable extract*. These leaves are occasionally adulterated with those of the Vaccinium *Vitis Idæa* (red whortleberry;) the fraud is easily detected by an infusion of the spurious leaves giving no traces of the presence of tannin or gallic acid on the addition of the usual tests.

Medicinal Uses.—Uva Ursi possesses astringent properties, and has been employed in cystirrhœa, and ulcerations of the urinary organs. It is also a useful medicine in hæmoptysis, menorrhagia, and other hæmorrhagic affections. It has been employed as a remedy in phosphatic calculous affections. *Dose*, of the powder, from ℈j. to ʒj., twice or thrice a day; of the decoction, from f ʒj. to f ʒij. twice a day.

Officinal Preparation.—Decoct. Uvæ Ursi.

ZINGIBER—ZINGIBER OFFICINALIS (Officinal Ginger).—Monand. Monogyn. Scitamineæ. East Indies.

The ginger plant is a native of the East Indies, and is particularly abundant in the mountainous district of *Gingi*, whence it derived its name. The root-stock, or *rhizome*, is the part in which the virtues of the plant reside. *White ginger* is prepared by selecting the best pieces, scraping, then washing, and drying them with great care in the sun. *Black ginger* is an inferior kind, which is merely scalded in boiling water to prevent germination, and is then quickly dried. The pungency of ginger resides in a resino-extractive matter which is combined with fecula, but which may be obtained separate by evaporating the ethereal tincture on the surface of water. Alcohol and water extract the *virtues of ginger*.



has been found useful in relaxations of the tonsils, and in paralysis of the muscles of and fauces. *Dose*, of powdered ginger, to ℈j.

Officinal Preparations.—Conf. Opii—Co mon.—Inf. Sennæ Comp.—Pil. Cambog Pil. Hydrarg. Iodidi—Pil. Scillæ Comp.— nam. Comp.—Pulv. Jalap. Comp.—Pulv. Comp.—Syrup. Rhamni—Syrup. Zingi Cinnam. Comp.—Tinct. Rhei Comp.—Ti beris.

PROPORTIONS OF OPIUM CONTAINED I FOLLOWING PREPARATIONS:—

Confectio Opii—about *one grain* in *thirty-six*. about *one grain and a half* in *four ounces*. Pil. Sap *one grain* in *five grains*. Pil. Styracis Comp.—*one grains*. Pulv. Cretæ Comp. cum Opio—*one grain* i Pulv. Ipecac. Comp.—*one grain* in *ten grains*. Pul —*one grain* in *a scruple*. Tinct. Camphoræ Comp *grains* in *an ounce*. Tinct. Opii—about *one grai*

PART V.

BOTANY.

A PLANT is divided into the *root*, the *body*, and the *fructification*.

The *root* consists of the radicle and descending caudex, the former being the part which absorbs nutriment from the earth, whilst the latter is that portion which extends from the surface of the ground to it.

Roots are annual, biennial, or perennial. The annual and biennial produce flowers and fruits but once, and then perish; the first completes its term in one year, the second throws out root leaves the first year, and completes its fructification the next.

The perennial root produces new flowers and seeds from year to year, and thus is prolonged indefinitely.

The *body* of the plant springs from the root, and terminates in the *fructification*; it consists of the trunk, the *leaves*, the *fulchra* or props, and the *hybernacula* or buds.

The fructification is a temporary part of the plant, but produces a seed containing the germs of a similar plant. It is composed of the stamen or male organ, and the pistil or female portion. The stamen consists of the filament and the anther; the pistil of the germ or seed bud, the style, and the stigma. They are generally protected by two coverings, the outward the calyx, the inward or corolla. The pistil in the last stage of the growth is the parent of the seed or seeds, which are either naked or enclosed in a pericarp or seed vessel. The *receptacle* is commonly considered as one of its parts, and connected with it is the nectary *or honey-cup.*

Plants are divided into classes, orders, genera, and species.

The classes are twenty-four in number, and are arranged chiefly from the number of the stamens in each: thus—

1. Monandria ...	1	Stamens.
2. Diandria.....	2	
3. Triandria ...	3	
4. Tetrandria ...	4	
5. Pentandria ...	5	
6. Hexandria ...	6	
7. Septandria ...	7	
8. Octandria ...	8	
9. Enneandria...	9	
10. Decandria ...	10	
11. Dodecandria.	12	
12. Icosandria.....		About twenty stamens.
13. Polyandria		Numerous stamens.
14. Didynamia		Flowers with two longer stamens.
15. Tetradynamia ...		Flowers with four longer stamens.
16. Monadelphia.....		Filaments united.
17. Diadelphia		Filaments forming two brotherhoods.
18. Polyadelphia ...		Filaments forming more than two brotherhoods.
19. Syngenesia		Anthers united.
20. Gynandria		Stamens on the pistil.
21. Monœcia		Staminiferous and pistiliferous flowers on the same plant.
22. Dicœcia		Staminiferous and pistiliferous flowers on different plants.
23. Polygamia		Different dispositions on the same plants.
24. Cryptogamia.....		Flowers inconspicuous.

The orders of plants are in like manner arranged

from the number of the pistils, as Monogynia, Digynia, &c., to the thirteenth class inclusive.

In the Didynamic and Tetradynamic classes none of the genera have more than one style; the order is therefore taken from the pericarp. The class Didynamia has two orders; the first distinguished by its naked seeds enclosed till ripe in the calyx, hence the name *Gymnospermia;* the second has its seeds in a pericarp, and is called *Angiospermia.*

The class Tetradynamia has also two orders—1, *Siliculosa,* from silicula, a little pod; 2, *Siliquosa,* from siliqua, a pod.

In the classes Monadelphia, Diadelphia, and Polyadelphia, the orders are named from the number of stamens, Triandria, Pentandria, &c. In the class Syngenesia are six orders—the first five are polygamia, or composed of numerous florets or little flowers.

1. Polygamia equalis—Florets possessed equally of stamens and pistils.

2. Polygamia superflua—Central florets only have stamens and pistils. Those on the circumference have pistils only.

3. Polygamia frustranea—Disk florets, have both stamens and pistils; those of the ray, neither, or abortive ones.

4. Polygamia necessaria—Disk florets with efficient stamens but abortive pistils. The pistils of the ray are impregnated by the disk stamens.

5. Polygamia segregata—Each floret has its own calyx. The whole is formed into one compound flower.

The classes Monœcia and Diœcia are distinguished by the number of stamens, by the union of the filaments or of the anther, or by the attachment of the stamens to the pistil.

The orders of the twenty-third class are determined by the number of stamens or plants on which the *several kinds of* flowers are found.

In the order Monœcia some flowers have and pistils, others have one of these only.

In the order Dicœcia, they are perfect a staminiferous, or perfect and only pistilliferous on two distinct individual plants.

In the order Tricœcia, the flowers are dis amongst three distinct plants.

The class Cryptogamia is divided into fo families—1. Filices, or Ferns—2. Musci, or M 3. Algæ, or Sea-weeds, but contains several to genera—4. Lichenes—5. Fungi.

Classification of Medicinal Plants.

	Class.	Ord
Anchusa		
Atropa, belladonna		
Capsicum		
Calicocca		
Chironia		
Cinchona		
Convolvulus		
Datura		
Erythræa		
Exogonium	Pentandria	Mo
Hyoscyamus		
Menyanthes		
Nicotiana		
Rhamnus		
Rutaceæ		
Solanum dulcamara		
Spigelia		
Strychnos		
Viola		
Vitis		

	Class.	Order.
m a i rum im Pentandria		Digynia
im um ia ium ca ella		
us	Pentandria	Trigynia
.....	Pentandria	Pentagynia
s lia ocarpus ra im oxylon lon lendron ia a is	Decandria	Monogynia
	Ditto	Digynia.
.....	*Ditto*	Pentagynia.

	Class.	Order.
Alpinia, Curcuma, Zingiber	Monandria	Monogynia
Gratiola, Galipea, Olea, Rosmarinus, Salvia, Veronica	Diandria	Monogynia
Piper	Ditto	Trigynia
Crocus, Iris, Valeriana	Triandria	Monogynia
Avena, Hordeum, Saccharum, Secale, Triticum	Ditto	Digynia
Dorstenia, Krameria, Rubia	Tetrandria	Monogynia
Acorus, Allium, Aloe, Scilla	Hexandria	Monogynia
Colchicum, Rumax	Ditto	Trigynia
Æsculus	Heptandria	Monogynia
Amyris, Daphne	Octandria	Monogynia
Rheum	Ditto	Trigynia
Asarum, Canella, Lythrum	Dodecandria	Monogynia
Agrimonia	Ditto	Digynia
Euphorbia	Ditto	Trigynia

	Class.	Order.
;dalus phyllus... ıs ıs a	Icosandria	Monogynia
.....	Ditto	Pentagynia
ɜntilla	Ditto	Polyginia
ɔalanops 'er	Polyandria	Monogynia
tum inium	Ditto	Trigynia
ɛria	Ditto	Tetragynia
ɔorus... ..	Ditto	Polygynia
ɔpus ıdula ıbium sa ha num ium	Didynamia	Gymnospermia
alis hularia	Ditto	Angiospermia
learia.....	Tetradynamia	Siliculosa
ımine ıis	Ditto	Siliquosa
ɾindus ...	Monadelphia	Triandria
a ea	Ditto	Polyandria
ɡala	Diadelphia	Octandria
ıgalus us ına ɾia ɔritia ɔcarpus	Ditto	Decandria

	Class.	Order.
Citrus, Melaleuca	Polyadelphia	Icosandria
Arctium, Lactuca, Leontodon	Syngenesia	Polygamia æqualis
Anthemis, Arnica, Artemisia, Inula, Solidago, Tanacetum, Tussilago	Syngenesia	Polygamia superflua
Centaurea	Ditto	Polygamia frustranea
Aristolochia	Gynandria	Hexandria
Euphorbia	Monœcia	Monandria
Morus	Ditto	Tetrandria
Arum, Quercus	Ditto	Polyandria
Croton, Cucumis, Momordica, Pinus, Ricinus	Ditto	Monadelphia
Salix	Dioecia	Diandria
Humulus, Pistacia	Ditto	Pentandria
Smilax sarsaparilla	Ditto	Hexandria
Menispermum	Ditto	Dodecandria
Juniperus, Myristica	Ditto	Monadelphia
Acacia, Stalagmitis, Veratrum	Polygamia	Monœcia
Ficus, *Fraxinus*	Ditto	Dioecia

	Class.	Order.
Aspidium	Cryptogamia	Filices
Fucus	Ditto	Algæ
Cetraria Islandica Roccella	Ditto	Lichenes
Boletus	Ditto	Fungi

The sensible qualities of plants are—1, Colour; 2, Odour; 3, Taste; 4, Touch.

Plants consist of:—

1. The *Epidermis*, or thin cuticle, which invests the whole of the plant.

2. The *cellular* or *reticular* substance which lies beneath the epidermis.

3. The *liber*, inner or true bark.

4. The *alburnum*, or *blea*, improperly called the sap, a ring of imperfect wood, between the liber and the true wood.

5. The *lignum*, or true wood.

6. The *pith*, enclosed in a longitudinal canal, forming the innermost part of the plant.

7. The *medullary productions*, filament proceeding from the pith and crossing the stem in a radiate direction.

8. The *medullary appendices*.

9. The *tracheæ*, or *air-vessels*.

10. The *sap-vessels*.

11. The vessels which secrete the peculiar juices of the plants.

A plant, like an animal, is a compound being, endowed with organization and vital action, and presents the phenomena of production, growth, maturity, and decay. It springs from a seed fertilized by the pollen of the parent plant. It absorbs nutrition from the earth, air, and water; it assimilates, excretes, secretes, respires, and has a circulation; and some *even move*.

Vegetables are composed of solids and fluids. The solid part consists of two elementary tissues, the *cellular* and *vascular*.

The *cellular tissue* consists of minute cells, utricles or vesicles, with thin and transparent sides. The cells vary in shape, some being globular, others hexagonal, &c. The cellular tissue is the pulp or parenchyma of old authors.

The *vascular tissue* consists of bundles of tubes or vessels, each tube being formed of one or more layers of elementary membrane; they are classed into the *porous*, *false spirals*, *spirals*, *mixed*, *beaded*, and *proper* vessels. They are also divided into the *sap*, or *ascending* vessels, which convey the fluid from the earth to the buds and leaves, and the *proper* or *descending*, which convey the excretory fluids back to the earth.

The Algæ, Lichens, &c. are destitute of vessels.

The principal organs of vegetables are the Conservative, which serve for their support, as the root, stem, branches, and leaves; and the Reproductive, consisting of the several parts of the flower and fruit, and form the seed or rudiment of the new plant.

The *roots* are classed into the *Fibrous*, as in wheat, oats, barley, &c.; *Creeping*, as in the couch grass, mint (mentha); *Fusiform*, as in the carrot, parsnip, &c.; *Abrupt*, as in the scabiosa succisa; *Tuberous*, as in the potato; *Bulbous*, consisting of three subdivisions, the *tunicate*, composed of layers, as in the onion; *solid*, as in the crocus; and *scaly*, as in the lily; *granulated*, as in the saxifraga granulata. Some plants have no roots, and vegetate in water, or on its surface. *Parasitical* plants are those which insert their root into other plants, and draw from them their nourishment, as the broomrape, dodder, and mistletoe.

The *stem* is that portion which grows upwards from the neck, and gives support to the leaves, flowers, and fruit.

Stems are divided by Linnæus into several kinds

he Caulis, Culmus, Pedunculus, Scapus, Petiolus, Frons and Stipes.

Stems are also divided, according to their structure, nto the Cellular, Endogenous, and Exogenous.

The *Buds* are those little bodies which grow on the surface of vegetables, and contain the rudiment of an entire plant, or part of a plant.

M. Rechard enumerates five distinct kinds of buds—he Proper or Common, the Turio, the Bulb, the Tubercle, and the Bulbil.

The leaves of plants are too familiar to require explanation.

Leaves are either simple or compound. In a *simple* eaf the petiole is undivided, and the lamina or disc consists of a single piece.

A *compound* leaf consists of several leaves or leaflets attached to a common petiole, and quite distinct from each other.

Leaves are *Caduous*, when they fall early, as in the plane-tree; *Deciduous*, when they fall before the new eaf appears, as in the horse-chestnut; *Marcescent*, when they wither before falling, as in the oak; and *Persistent*, when they remain during the winter, as in he laurel, &c.

When the fibres spread out on leaving the stem, eaves are termed *Sessile*, as in the white poppy. When he fibres are clustered together before they expand, hey form a petiole or footstalk, as in the horse-hestnut. In some leaves, as in the mimosæ of New Holland, the lamina is not developed, and the petiole becomes expanded or leafy, in which case it is called *Phyllodium*.

The lines on the under surface of the leaves are the amifications of the vascular fibres from the stem, and re called veins or nerves; they open on the surface f the leaf in the *stomata*.

The central line or vein is called the midrib, and rom this the other lines are seen to diverge.

Plants without leaves are termed *Aphyllæ*, as the glass-wort (*salicornia*).

Nutrition of Plants.—One set of vessels proceed from the stem to the upper surface of the leaf, and convey the sap to be exposed to the air and light; another set proceed from the lower surface, and convey the sap to the bark to nourish the plant.

The evaporation from the surface of the leaves varies much in different plants, and is of use in regulating their temperature.

The *appendages* of plants are the *Stipules*, *Tendrils*, *Spines* or *Thorns*, *Prickles*, *Glands* and *Hairs*.

Vegetables consist principally of carbon, oxygen, and hydrogen, but contain also small quantities of nitrogen, lime, magnesia, &c.

Respiration of Plants.—Leaves, when exposed to the light, exhale or give out oxygen gas, which they obtain from the carbonic acid of the atmosphere, conveyed to them through the sap, retaining the carbon; in the night, on the contrary, they absorb oxygen and give out carbonic acid.

PART VI.

PRACTICE OF MEDICINE AND PATHOLOGY.

FEVERS.

A *fever* signifies a peculiar disturbance and disorder of all or nearly all the fluids and solids of the living body, and of their functions.

The most *common signs* of fever are shivering, followed by heat of skin, restlessness, and thirst; headache, flushed face, and quick pulse; general aching, and debility of the body.

There are very many varieties of fevers; and the first grand distinction is into the *idiopathic* or essential, and the *symptomatic.*

By an *idiopathic* fever is meant one which exists *of itself;* not being produced by or dependent upon disease of any particular organ of the body.

By a *symptomatic* fever is meant one which depends upon or is caused by inflammation, or other local disease.

Idiopathic fevers are often *accompanied* by inflammation ;—thus inflammation of the mucous membrane of the throat accompanies scarlatina; inflammation of the cerebral membranes, or lungs, or intestinal mucous membrane, may be combined with typhus. Dr. Clutterbuck believed that it depended on inflammation of the brain ; and the followers of Broussais, in France, on an inflammation of the mucous membrane of the stomach and bowels, or gastro-enterite, as *they called it.*

But this is not correct, as many have died of typhus in whom no local disease has been found after death.

Idiopathic fevers are most commonly caused by some morbid poison.

Symptomatic fevers may be of an acute inflammatory, hectic, or typhoid type.

Fevers are classed as follows:—

INTERMITTENTS.—*Varieties.*—Quotidian, Tertian, Quartan, &c. *Morbid results—Congestions in liver and spleen, and ascites.*

REMITTENTS.—*Varieties.*—Mild remittent; remittent of hot climates. *Morbid results—Inflammation of alimentary mucous membranes, black vomit, dysentery,* &c.

CONTINUED FEVERS.—*Varieties.*—Synocha, Synochus, Typhus. *Morbid results—Congestion and effusion in the brain; engorgement of the lungs; inflammation and ulceration of Peyer's glands in the small intestines.*

EXANTHEMATA.—*Varieties.*—Small Pox, Cow Pox, Chicken Pox, Measles, Scarlatina, Erysipelas, Plague.

INTERMITTENT FEVERS, OR AGUES.

Causes.—They are produced by a subtle atmospheric poison, which has received the name of *malaria*, or *marsh miasma*. It has commonly been said that this poison is produced by the putrefaction of vegetable substances; but it seems that a certain amount of heat and moisture are sufficient, without any vegetable matter. Thus it is very abundant on many sandy soils, where there is no vegetation at all; and—it must be noticed, that it does not proceed from lands which *are* inundated, so much as from those which *have been* flooded and *are* drying. It is more virulent *in* hot climates than in temperate—in low situations than in high.

Varieties.—The three most common varieties are

. The *quotidian*, in which the fit comes on every
, generally in the morning, and lasts about ten or
lve hours. 2. The *tertian*, which comes on alter-
e days, generally about noon, and lasts till evening.
The *quartan*, which comes on once in three days,
ally in the afternoon. It has the longest cold fit,
the shortest paroxysm altogether.
A distinction is made between the *interval* and the
rmission of an ague. The interval is the space
ween the beginning of one fit, and the beginning of
next; which in the tertian is forty-eight hours;
intermission is the space from the *end* of one fit,
the beginning of the next: in other words, the
e the patient is free from the disease; which in the
ain is about forty-two hours.
ymptoms.—An ague fit consists of three stages:
. The *cold stage.*—This begins with chilliness and
striction of the whole body; the nails are blue;
rings drop off the fingers; the skin is rough (*cutis
erina*), and there are violent shiverings, and chat-
ng of the teeth; head-ache and back-ache, quick
ll pulse, oppression at the pericardia, and some-
es vomiting. After these have lasted some time,
re comes the
nd, or *hot stage*, beginning with flushes of heat,
ch gradually increase, till the skin becomes very
and dry, the face flushed, the temples throbbing,
the pulse full and hard. After a duration of
n three to eight hours, comes the
rd, or *sweating state.*—Perspiration begins on the
d and face, and becomes profuse all over the body,
the urine deposits a copious lateritious sediment.
w, in uncomplicated cases, the patient feels well,
weak, till the next recurrence of the fit.
reatment in ordinary cases.—First of all, give a
n or two of calomel with an aperient, so as to clear
bowels. If the stomach is very foul, an emetic.
he paroxysm.—During the cold stage, warm drinks

of tea, or wine-and-water; hot foot-bath; warm bed; frictions of the spine. During the hot stage, cool drinks; and after the sweating, let the skin be rubbed dry with warm towels.

When the fit is over, begin with some *antiperiodic remedy*, to prevent its recurrence. The best is *quinine*, of which from two to four grains should be given every four hours, in solution with a few drops of dilute sulphuric acid, tincture of orange-peel, and water. The remedy should be continued in gradually decreasing doses, for ten days or a fortnight after the last fit, as the complaint is very apt to return.

The next best remedy is *liquor arsenicalis*, in doses of ɱv.—x. ter die. Other remedies are, willow bark, piperine, sulphate of zinc, ammonia, sulphate of copper, and, in fact, all vegetable bitters and astringents.

Opium given in a full dose sometimes puts off the fit, if given just before it is expected; and it is also of great use to shorten the *hot stage;* but not of much service in the cold. *Bloodletting* was recommended by Dr. Mackintosh, but in ordinary cases is now repudiated by most English physicians.

Enlargements and induration of the liver, and especially of the spleen, the tumour formed by which is commonly called *ague cake*, form in long-continued ague, and are followed by dropsy.

REMITTENT FEVERS

Resemble the preceding, but differ in this, that the patient is never wholly free from the fever; they are most frequently met with in children.

Mild remittent.—For several days previous to the *invasion*, the patient complains of uneasiness at the epigastrium, lassitude, pains in the back, limbs, and head, and restlessness at night. The invasion is attended by coldness of the surface, and frequently by shivering; this coldness is soon succeeded by

ieat, by febrile flushes, or by alternations of heat and old, by nausea, and occasionally by vomiting. The ains in the head, back, and limbs now become ggravated; the mouth is clammy and dry; the ongue white or loaded; the surface very hot and arched; the face flushed; and the pain of the head ttended by a feeling of distension and throbbing, ften passing into delirium. The pulse is full, hard, nd frequent; thirst is urgent; the bowels consti- ated; and the urine scanty and high-coloured. There s always more or less epigastric tenderness, with ausea, and often with vomiting. These symptoms enerally continue from about ten or twelve to eighteen ours, when perspiration breaks out; the pulse falls n frequency and strength; delirium disappears, and he irritability of the stomach subsides: there is nerely a remission or abatement, but no intermission f the febrile symptoms. This fever has a particular lisposition to a favourable critical change on the 'th, 14th, 21st, and 28th days; but in warm countries t seldom continues longer than 14 days.

The inflammatory form.—This form generally attacks plethoric Europeans residing in warm miasmatous limates. It differs from the preceding merely in grade, the symptoms being much more violent. If his form be at all neglected at the commencement, he remissions disappear; the skin becomes dry and harsh, or moist and clammy; the pulse small and irregular; the tongue black and crusted; and the vomiting, and pain at the epigastrium, more constant. In the most unfavourable cases, yellowishness of the skin, or vomiting of matter like coffee-grounds, or both, occasionally supervene. The bowels become irritable, the evacuations being watery, greenish, and, at last, almost black. If the disease be not actively treated, it terminates fatally between the third and seventh days.

Bilio-inflammatory remittent fever.—This form differs

but slightly from the foregoing in its symptoms and course. Violent determination to the brain characterizes the commencement of reaction in this variety; and inordinate affection of the liver and mucous surface, the more advanced stages.

Malignant remittent.—This is one of the severest and most fatal of endemic fevers. As its name implies, the disease is of a malignant or typhoid type from the commencement.

Complications. — *Gastro-duodenitis* is among the earliest complications of remittents; in the more advanced stages, *dysentery* occasionally comes on. Diseases of the *liver* and *spleen* are common attendants on remittents, especially in the East Indies and warm climates. *Determination of blood to the brain* often occurs early in the more severe remittents. In temperate climates, remittents are frequently associated with *bronchial* or *pulmonary affections.*

Treatment.—In the *mild form,* before reaction comes on, and when there are no indications to forbid its administration, an *emetic* is generally very useful. After its full operation, a large dose of *calomel,* or calomel and opium, may be given, and an action be produced on the bowels by *purgatives* and cathartic enemata. These means being repeated until morbid secretions and fæcal accumulations are removed, *bark* or *quinine* may be prescribed, if the remissions are distinct. In some cases, where the patient's strength will admit of it, *moderate bleeding,* in the stage of excitement, will shorten the disease, and render the remissions more perfect. During reaction, in the early exacerbations, frequent doses of *James's powder* with *calomel,* or *tartarized antimony,* given in repeated doses, will oftentimes promote a favourable termination. Any complications that may be present will require distinct treatment, according to the organs that are affected.

INFANTILE REMITTENT FEVER.—This disease usually

;tacks children from nine or ten months to twelve or ıirteen years old. It generally arises from errors in .et, and accumulation of morbid matter in the primæ iæ. It may also arise from most obscure miasmata.

Symptoms.—This affection commences gradually; ıe bowels being irregular, generally costive, but oc- ısionally relaxed and irritated. The child remains ıverish and drowsy towards evening, but generally ɜems pretty well in the morning. The appetite is ariable; the pulse ranges from 100 to 140; and the ɔngue is loaded. After these symptoms have lasted ɔr several days, a distinct chill or rigor is sometimes bserved; vomiting ensues; and a more violent aroxysm of fever, drowsiness, flushed cheeks, and ıooting pains through the abdomen and head, follow. 'he child constantly picks its lips and nose; and ccasionally stiffness of the neck, great sensibility of ıe general surface, and tenderness in the course of he spine, are observed. In the more advanced tages, the ingesta are either thrown off unchanged, r passed undigested from the bowels. In very young hildren, *convulsions* come on; in those of more ad- anced age, *delirium* often attends the night exacer- ations. This is the most common form of the isease.

Diagnosis.—In infantile remittent fever, the cerebral ymptoms do not appear until near the close of the isease; in hydrocephalus, they invariably occur be- ɔre the end of the first week, and oftentimes sooner. 'he acceleration of the pulse, the remissions and the iarrhœa, which are also constant symptoms of in- ıntile remittent fever, will serve to distinguish it from cute hydrocephalus, in which the bowels are always onstipated from the commencement of the disease, nd the pulse occasionally slow.

Treatment.—If the affection be acute, and the hild strong, *leeches* should be applied to the epigas- rium, *calomel and James's powder* ought to be given

at night, and a mild aperient draught in the morning. If the bowels are not evacuated by these means, an enema should be given; and, according to Dr. Copland, equal parts of castor oil and oil of turpentine in water-gruel form the best enema in those cases. The calomel and James's powder should be repeated every night, or on alternate nights; to be followed, if necessary, by opening medicine. When the evacuations have been improved by these means, mild tonics may be employed; of these, the *infusions of cinchona, cascarilla*, and of *valerian*, form the best; *stimulating liniments*, and other *counter-irritants* should be applied to the abdomen. The *foot-bath*, some mustard flour being added to the water, will be found useful at bedtime. Small doses of *sulphate of quinine* may be exhibited; and if the disease assume the adynamic form, small doses of *chlorate of potass* in an infusion of *valerian* or of *cinchona* may be given with advantage. Where the disease has produced mesenteric obstruction, small doses of *iodide of potassium* may be exhibited. When convalescence is established, the *vinum ferri* will be found a useful tonic.

HECTIC FEVER.

Hectic fever is a remittent fever, *rarely, if ever, idiopathic*, but depending upon some local source of irritation.

Symptoms.—Hectic fever is attended with great and increasing debility, a weak, quick, and rather hard pulse, hurried respiration on any exertion, and increased heat of the skin. The exacerbations, which are at first slight, soon become more evident, particularly in the evening; are preceded by a slight or marked chill; are attended by increased heat, which is most evident in the hands and face, the skin being at first dry, and terminate in a free, profuse perspiration, especially the evening paroxysm, which subsides

this manner early in the morning. The bowels are first costive, but soon become relaxed, and *colliative* diarrhœa comes on: the urine is various; nerally it is pale, and does not deposit; more rarely, is high coloured, and yields a lateritious sediment. hile there is general pallor of the surface, the eeks present what is very aptly styled the "hectic ush." As the disease advances, the whole frame comes emaciated; the eyes are sunk in their orbits, it are brilliant and expressive; the ankles and metimes the legs are œdematous, and the sleep is verish and disturbed. At last, the diarrhœa and colquative sweats become more abundant, and the spiration more hurried, and the debility so great at the patient expires while making some slight ertion.

Treatment.—This must essentially depend on the use or pathological state which occasions the hectic ver. Mineral acids, &c., are most useful. Of the ids, sulphuric acid, given in infusion of roses, is to preferred. The extracts of conium, hyoscyamus, d humulus, are occasionally given; opiates may so be had recourse to.

CONTINUED FEVERS

re so named from their not being attended by remisons or intermissions of the symptoms. Under this ead are the *common continued fever*, or typhus, and varieties; the exanthemata; viz., small-pox, measles, scarlet fever, chicken and cow pox, and erysipelas. yphus also may be classed under the exanthemata, it has a peculiar eruption.

These are called *zymotic* diseases in the Registrar-eneral's reports; because the morbid poison, which supposed to produce them, seems to act like a *ferent.*

An *interval of from* five to twelve days generally

elapses between the reception of the infection and the outbreak of the disease: this is called the stage of incubation.*

The following are the chief remedies used in fevers, and the indications with which they are given.

Bleeding is employed to diminish the mass of the blood, and to lessen the force of the circulation. When it is right to employ it, the system always shows a *tolerance* of it: that is to say, can bear more bleeding without faintness than in a state of health. If faintness occurs after the loss of very few ounces, it is generally a sign that it is injurious. *Local bleeding* unloads the vessels of an inflamed or congested part, and eases pain and tension. *Purgatives*, including *calomel*, given as a purge, remove irritating and offensive secretions from the intestines, and purify the blood by causing a flow of bile and of intestinal secretion. *Saline medicines* restore to the blood a proper quantity of saline matter, which is often absent in fever: they cool the system, and increase the secretion of urine. *Acids* quench the thirst and cleanse the inner surface of the mouth and stomach, removing morbid deposits of epithelium. *Antimony* lowers the rate and force of the circulation, and causes perspiration. *Diaphoretics* consist either of *nauseants*, which cause perspiration by relaxation, or of stimulants, such as ammonia, liq. am. acet., &c., consisting of substances that tend to exhale through the pores of the skin.

CONTINUED FEVER (*Synocha, Synochus, Typhus*, of Cullen).—Fever is a disorder liable to very great variation in the *kind* and *degree* of its chief phenomena; hence it appears under very different aspects at different times, and in different places; and it has received a great variety of names.

* Most of the statements found in the few following pages are taken from Dr. Watson's admirable Lectures on the Practice of Physic.

Sometimes it has received a name from the locality where it was prevalent; as, *camp fever*, *gaol fever*, &c.; sometimes from its duration; as, *twenty-one days' fever;* sometimes from the predominance of particular symptoms in particular epidemics; as, *brain fever*, *bilious fever*, nervous, putrid, typhus, petechial, spotted, ataxic, adynamic, gastro-enteritic, &c. &c.

These are, most probably, produced by some atmospheric poison, and capable of being propagated by contagion.

Symptoms.— Before the attack, the patient generally exhibits certain premonitory symptoms, resulting from an oppression of the nervous system and altered state of the blood. He is low-spirited and languid; loses his appetite; the bowels are irregular; and he feels ill without knowing why. Violent shivering, or diarrhœa, is often the immediate precursor of the disease.

Dr. Watson divides the symptoms into *weekly stages.* In the first week the symptoms are such as belong to the circulating system; frequent pulse, hot skin, thirst, and headache. The tongue clammy or furred, or clean and dry, or perhaps with streaks of white fur. The abdomen usually tense: bowels sometimes confined; sometimes the reverse, with fœtid unhealthy secretions. There is usually some irritation also of the air passages, with cough and crepitation. But, amidst all these symptoms, says Dr. Watson, 'those which relate to the nervous centres are still imperceptible." The aspect of the patient is peculiar; the features fixed and inexpressive; or expressive merely of apathy and indifference. Delirium does not generally come on till towards the end of the first week. The muscular power is greatly depressed. The patient lies on his back, motionless: he sleeps but little, waking often, and perhaps fancies he does not sleep at all. The urine is generally scanty and high coloured.

At the end of the first week, in *mild epidemics*, the fever perhaps begins to abate; but in most cases, it is then, and during the second week, that the severer, *low*, or typhoid symptoms show themselves more distinctly. The pulse is more frequent and feeble; the tongue drier and browner; the teeth covered with black sordes; the patient lies on his back, and sinks down towards the foot of the bed. Delirium comes on, first at night, but afterwards is persistent during the day; the patient wandering, muttering, talking incoherently, making no complaint of pain, to which he seems insensible; neglecting to pass his urine, and letting his alvine evacuations escape unheeded.

It is during the second week also that the *rash, peculiar to typhus*, shows itself, in the form of "small rosy blotches, of a rounded or lenticular shape;" scarcely, if at all, raised above the surface of the skin, and not entirely disappearing on pressure. (Neither *petechiæ* nor flea-bites should be confounded with them.)

Great diarrhœa, with thin yellowish dejections, and tenderness over the region of the cæcum (right iliac fossa), especially if there is hæmorrhage from the bowels, show intestinal ulceration to be present.

Petechiæ, and *vibices*, are spots of ecchymosis, red at first, and gradually becoming of a greenish purple, produced by an extravasation of blood under the skin; they are unfavourable signs, as they show a thin, decomposed state of the blood. They are, too, often accompanied with hæmorrhage from the bowels: these are often called *putrid symptoms*.

During the third week, if the patient is about to recover, his symptoms abate; the countenance brightens; and the evacuations are more healthy. The contrary happens if death occurs.

Death from fever.—Chomel, as quoted by Dr. Watson, states, that out of forty-two fatal cases, one died in the first week, nine in the second, and the remaining thirty-two in the third.

ses of death.—The most common cause of death
ar is *coma;* that is, a suppression of the func-
of the brain; the patient falling into profound
, from which he never wakes. And this, says
Watson, may arise from two causes. First, the
may be merely oppressed by the poisonous blood,
it would be by opium; or, secondly, there may be
on of serum. Sometimes there is superadded an
ial inflammation of the brain or its membranes,
very hot head, flushed face, &c.

ondly, death may occur from *apnœa:* that is,
interruption to the functions of the lungs, arising
engorgement or inflammation; the symptoms
quickness of respiration, and crepitus, discovered
scultation.

irdly, death may be caused by *debility (asthenia),*
he vital powers are most apt to fail in persons
have been injudiciously bled, or have suffered
exhausting diarrhœa.

ORBID APPEARANCES.—In the *head:* "in 15 cases
f 38 Chomel found no morbid appearances at all;
, very slight serous effusion in the ventricles; in
usion in the meshes of the pia mater; in 6, a
diminution of consistence; in 2, some alteration
sity; in 5, a speckled appearance of the cerebral
ance."

est.—The lungs are often found engorged with
; their lower and posterior portions are espe-
loaded, from mere gravitation (this is called
static congestion); but there are sometimes also
itic effusions, hepatization, purulent infiltration,
obstruction of the bronchi by viscid mucus, as
of inflammation. The heart sometimes softened
laccid.

domen.—The spleen often enlarged, dark coloured,
otten. The liver softened: but the most cha-
ristic morbid appearance is thickening, or ulcera-
of *the mucous follicles* of the small intestines;

especially of the oval patches called Peyer's glands, which are most frequent in and near the termination of the ileum. The corresponding mesenteric glands are also enlarged.

The *blood* is generally black, and forms a soft coagulum.

Varieties of fever.—Fever is liable, as was before said, to great varieties as to the organ on which the fever poison spends most of its force. It is also liable to great varieties of *type*; being sometimes of an inflammatory type, and bearing bleeding well; sometimes of a typhoid type entirely, with very great depression of the powers of life, in which bleeding would be utterly inadmissible. Cullen expressed the leading types of fever by three names—synocha, synochus, and typhus. *Synocha* is the inflammatory type, with full strong pulse, and great heat: *Typhus* is the low type; little heat, great prostration of the nervous system: *Synochus* is that which is most commonly met with; for it begins with more or less of the inflammatory type, and ends with the typhoid. Fever also varies in *duration*; for in some epidemics the disorder begins to abate on the 5th, 9th, or 14th days.

Crises.—A *crisis* (κρινω) signifies some phenomenon occurring in a disease, by which we *judge* that a change is taking place for better or worse. The ancients reputed certain days, especially the 7th, 14th, and 20th, to be *critical days*. The phenomena attending a favourable crisis are, a previous aggravation of the symptoms; then an increase in some of the secretions; either sweating, or copious stools, or copious urine, depositing a thick sediment; together with moisture of the tongue, and *natural sleep*.

In the first stage, if there is much nausea and gastric disturbance, a mild *emetic* of ipecacuanha may procure relief. The bowels should be cleared out by active *aperient* at the outset; say three grains of calomel, with rhubarb, and be kept open by mild

loses; viz.—hyd. c. cret., followed by castor oil, or an injection. *Mercury*, gently given, so as to touch the gums, has seemed of service in some epidemics, but not in others.

The hair should be removed; and the head be bathed with cold lotion as long as there is much headache, and as long as it is *agreeable to the patient*. If there is *great general heat* of skin, the whole body may be sponged with tepid water.

Blood letting should never be practised from mere routine, but reserved to combat any local inflammation that may arise.

If the headache is very intense, with great heat, flushed face, and wild delirium, a *small* bleeding in the erect posture; or rather a few leeches, or the loss of a little blood by cupping from the neck, will be advisable. Profound coma should be treated by a large blister to the shaven scalp.

If there is much tenderness at the epigastrium, or over the cæcum, a few leeches may be applied, and after them, a poultice. A small dose of hyd. c. creta also every night, with an equal quantity of Dover's powder, if the diarrhœa is profuse.

Great dyspnœa, with other signs of inflammation in the chest, must be combated by a cautious cupping, followed by a blister, or mustard poultice; and small doses of senega.

Very obstinate and profuse diarrhœa must be checked by opiate enemata; blisters or mustard poultices to the abdomen, and small doses of catechu with chalk mixture. In the same cases, æther and other stimulants may be given.

If the type of the fever is very *low*, and there is great feebleness, it will be necessary to give good *beef tea*, and small quantities of *wine* from an early period; and this need not hinder leeches from being applied to combat any local congestion.

The use of opium in fever is nearly the same as that

of *wine*. The general rule is to give *opium*, when nervous excitement exceeds vascular action; where there is much delirium, and sleeplessness, with a feeble pulse. In some cases it is right to give a good dose at once; in others, to feel the way cautiously with small doses. In some cases of excitement in young subjects, opium may be given in small doses, gr. ¼, with tartar emetic, gr. ⅛.

Opium and wine may be known to do good in fever, if they make the skin and tongue moist, the pulse fuller and slower, and if they allay nervous excitement, and produce sleep.

The state of the bladder should be inquired into every day; and the bed be kept dry and clean. Any spots that seem likely to ulcerate, should be washed with brandy, and protected with soap-plaster.

Perforation of the intestines from ulceration is one of the most distressing sequelæ of fever. It is denoted by sudden agonizing pain radiating over the whole belly; great faintness and sickness, followed by symptoms of peritonitis; great tenderness, knees drawn up, &c. The only palliative is opium; but death generally soon puts an end to the patient's misery.

To conclude: the chief indications in the treatment of fever are, to nurse the patient carefully through it; to allay excitement; to prevent local inflammation; and to support the strength.

Miliary Fever.—In former times, when it was the custom to subject sick people and lying-in women to extreme heat, by stopping up all the doors and windows, lighting a large fire, and loading the bed with blankets, a peculiar attack of feverishness was often superadded to the original malady, attended with profuse sweating and an eruption of millet-shaped vesicles, called *miliaria*, or *sudamina*. This affection is now seldom or never met with: should it occur, cool air and drinks should be the remedies.

There is also a peculiar contagious fever, called the

Sweating Sickness, sometimes also called *miliary fever*, which was formerly very prevalent and fatal in England, and is now occasionally met with in France. It is a typhoid fever, with profuse fœtid perspiration; and requires the same general treatment as has been already detailed.

RUBEOLA (*Measles*).—This is a contagious fever, with eruption and catarrh.

Symptoms.—Lassitude, shivering, pyrexia, and catarrhal inflammation of the mucous membranes, watering of the eyes, sneezing, intolerance of light, dry hoarse cough, with dyspnœa, and frequent and hard pulse. The eruption appears on the fourth day when these symptoms subside.

When the eruption is fully developed, the frequency of the pulse, heat, thirst, redness of the eyes, and coryza, disappear, or are much alleviated; the nausea and vomiting also subside. About the sixth day, the watchfulness disappears, the cough and dyspnœa being the only symptoms that remain. On the third or fourth day of the eruption, the spots become pale, and gradually assume a yellow tint; and when the redness has disappeared, the epidermis becomes detached in small furfuraceous scales.

The *prognosis is unfavourable* when the child is very young, when the eruption appears before the third day, or when it suddenly disappears. A leaden hue of the spots, petechiæ, or excessive dyspnœa, are also unfavourable signs. The *prognosis is favourable* when the gastro-pulmonary symptoms are slight, the progress of the disease is regular, and when the skin is moist after the appearance of the exanthema.

The *sequelæ* of *rubeola* are, bronchitis, pneumonia, pleuritis, cæco-colitis, or diarrhœa.

Treatment.—When the gastro-pulmonary symptoms are slight, the treatment merely consists in keeping the patient in a mild temperature, on spare diet, and *giving mild laxative* and diaphoretic medicines. If

the soreness of the throat be very troublesome, the inhalation of the vapour of warm water is useful.

As a general rule, all inflammations that precede, accompany, or follow rubeola, when severe, should be treated as though that exanthema was not present. Diarrhœa frequently comes on during the convalescence, and, if not too severe, is useful in checking a tendency to thoracic disease; should it, however, proceed too far, small doses of Dover's powder, and the occasional use of the warm bath, will be found useful, except in young children, in whom the use of this medicine is hazardous. A common sequela of measles is, a short hoarse and barking cough, which has a great deal of the croupy sound, but is not attended with dyspnœa. It readily yields to counter-irritants.

SCARLATINA.—This is a contagious fever, particularly affecting the mucous membrane of the throat. About the second day of the affection, the whole surface of the body presents *little red points*, which are soon followed by patches of a *deep scarlet colour*, serrated at their edges, which become confluent, and terminate by desquamation on the fifth or sixth day.

Scarlatina occurs under three forms—Scarlatina simplex, S. anginosa, and S. maligna.

SCARLATINA SIMPLEX.—The precursory symptoms of this form are, general debility, nausea, shiverings, followed by flushes of heat and thirst. On the *second* day of the febrile symptoms, *little points*, at first of a light red, then becoming deeper, appear in great numbers on the face, neck, and chest. In the course of twenty-four hours, similar spots appear on the body, lips, tongue, palate, and pharynx. On the *third* day, most of the interstices which had been left are covered with large dotted patches, having serrated edges. In *this stage*, the pulse is full and frequent, the tongue is covered with a creamy coat, through which the red and elevated papillæ point. This produces the peculiar appearance of the organ to which the term straw-

berry-like tongue is applied. The skin is much hotter in this form of exanthema than in any other. The scarlet colour is of a *deeper tint* on the groins, buttocks, and folds of the joints, than in other situations.

About the *fifth* day the interstices between the patches become larger, the scarlet colour less vivid, and slight desquamation takes place on the neck, temples, and chest. On the *sixth* day, the characters of the disease become less distinct; and on the *eighth* and *ninth* days, desquamation from the surface of the hands, feet, and the different regions of the body, takes place.

SCARLATINA ANGINOSA. — *Symptoms.* — This form commences with more intense fever, and a sense of stiffness of the neck and inferior maxilla. On the *second* day, the pharynx is inflamed, deglutition is difficult, the amygdalæ become swollen, and the mucous membrane presents a vivid red appearance. In the S. simplex, the pharynx presents an exanthematous blush, but there is no effusion; in this form, however, a quantity of thick, viscid fluid, sometimes of a whitish yellow colour, but more generally caseous-like matter, is thrown out on the amygdalæ, pharnyx, and anterior pillars of velum. During the *second, third* and *fourth* days, symptoms of gastro-enteritis are present; the tongue is of a bright red colour; there is nausea, vomiting, diarrhœa, or constipation, dry cough, quick and vibrating pulse, and occasionally epistaxis. The eruption, which appears on the *third* day, is not so generally or equally distributed as in the former affection. It also sometimes disappears suddenly, frequently on the day after its appearance, and returns again after an uncertain period of time. The entire duration of this form is longer than in simple scarlet fever, and its order of appearance, and that of its desquamation, is not so regular.

SCARLATINA MALIGNA. — *Symptoms.* — This form comes on like the scarlatina anginosa, except that the

symptoms are of a graver type even on the first accession. Sometimes, in fact, the patient is stricken dead by the poison in a very few hours, before any eruption or local symptoms come on. The eruption does not present a scarlet appearance, but is more of a livid hue, and frequently interspersed with petechiæ. It is irregular in its first appearance, and it may disappear and reappear several times. In this form of scarlatina, the pulse is small and irregular, the teeth and tongue are covered with brown or black incrustations, the eyes are much injected, and the vision is confused; the respiration is laborious, and the breath is fœtid; the pharynx is covered with thick, viscid mucosity, and there is often sloughing of the surface of the amygdalæ. Convulsions and coma are frequent concomitants of this affection in children, while delirium and deafness attend this form in the adult. The appearance of numerous petechiæ, of abundant diarrhœa, of difficult respiration, or of persistent coma, announce the approach of death. The *sequelæ* of *scarlatina* are, anasarca, ophthalmia, otitis, bronchitis, enteritis, orchitis, and cynanche parotidea, in the adults; affections of the sub-maxillary and inguinal glands, &c., in children.

Treatment.—In scarlatina *simplex*, when the bowels are constipated, mild purges may be employed. Rest in bed, spare diet, cooling acidulous drinks, and where the surface of the body is extremely hot and burning, cold sponging, are the means principally to be relied on.

In scarlatina *anginosa*, and *maligna*, the treatment must be the same in its *nature* as that of continued fever, but be varied to meet the symptoms. If there is violent cerebral excitement, or inflammation of the throat, a few leeches may be applied; but if the powers of life are low, it may be necessary to give wine, beef-tea, &c., from the very commencement. The *throat* always requires great attention; the patient, if able, should assiduously use a gargle containing

muriatic acid, or chloride of soda, and should inhale the steam of vinegar and water; and if not able to do so himself, the same liquor should be copiously injected through the nose and mouth from an elastic bottle. The bowels should be regularly cleared by mild aperients and enemata. The citrate of ammonia, given in a state of effervescence, is an excellent medicine in most cases. Cool sponging is of service when the heat of the surface is steadily high; but in malignant cases it is to *wine* that the practitioner has chiefly to look for the safety of his patient.

During convalescence, the patient should be protected from cold, and ought occasionally to employ tepid baths, and frictions to the surface.

ERYSIPELAS.—This is an exanthematous fever affecting the skin, or the subcutaneous cellular tissue, or both.

There are two chief varieties, the *simple*, which affects the skin, and ends in vesication and œdema; the *phlegmonous*, which affects the subcutaneous cellular tissue likewise, and causes unhealthy suppuration and sloughing.*

SIMPLE ERYSIPELAS. — Erysipelas always begins with shivering, nausea, and other signs of fever, and derangement of the stomach. The skin of the part affected becomes slightly swollen, and of a red colour; there is acute pain, with a sensation of burning heat, but no throbbing as in phlegmon. The redness disappears on the slightest pressure, and reappears immediately on its removal. In some instances, small miliary vesicles appear, in others bullæ or phlyctenæ are observed. The most favourable termination is in resolution, in which case the epidermis is thrown off in small scales. It occasionally assumes an *erratic* form, and sometimes it terminates by *metastasis* to some of the internal organs.

* *For an excellent account of this disorder, see Druitt's Burton's Vade Mecum.*

PHLEGMONOUS ERYSIPELAS.—In this form the redness is very vivid, and diminishes in intensity from the centre to the circumference. The cellular tissue being implicated in this affection, produces swelling, hardness, and a burning pain. This affection may terminate in resolution; but should it proceed to suppuration, and measures are not employed to allow of the exit of the pus, abscesses will form, and the cellular tissue between the muscles will become implicated. The abscesses and sinuses thus formed, will gradually burst externally, when a quantity of gangrenous masses, mixed with fœtid pus, will be discharged. The constitutional symptoms in this case indicate that much mischief is going on. The pulse becomes quick and hard, and the tongue brown; encephalitis, meningitis, or gastro-enteritis, may come on, and the patient sinks under diarrhœa, with low muttering delirium and coma.

In the *phlegmonous* form free incisions followed by poultices are necessary; bleeding from the incision should be carefully watched Where sloughing has occurred, lint dipped in oil of turpentine, or in equal parts of it and Peruvian balsam, should be applied to the incised parts, and covered by poultices.

VARICELLA (Chicken Pox.)—*Symptoms.*—Varicella is a contagious fever, attended by vesicles or pustules, which dry up from the fourth to the seventh day of their formation, generally leaving small red spots, but rarely cicatrices on the skin.

Treatment.—When varicella is distinct and apyretic, the treament is very simple; the patient should remain in bed in a temperate atmosphere, have a mild purge, ought to be placed on low diet, and abstain from animal food for a few days, and should partake freely of diluent drinks. Tepid baths may be employed during convalescence.

VARIOLA (Small Pox).—This is a contagious erup-

tive fever, affecting at the same time the gastro-pulmonary mucous membrane and the skin. It shows itself externally from the third to the fourth day of the febrile invasion. At first it is *papular*, it then becomes *vesicular*, and next *pustules* are formed, which at first are *pointed*, and then become *umbilicated*. This affection terminates, after from twelve to fifteen days' duration, in desiccation and scabbing, small irregular cicatrices remaining.

Variola is commonly divided into the distinct and confluent forms. In the *distinct*, the pustules are few and thinly scattered over the whole surface of the body. In the *confluent*, the pustules are numerous, and are more or less united by the close approximation of their edges.

Variola presents *four stages*—1st, that of *incubation*, or the *latent period;* being that which intervenes between the absorption of the poison and the first appearance of symptoms; 2nd, of *invasion;* 3rd, of *eruption;* 4th, of *desiccation*.

The latent period varies from *six* to *twenty* days.

On the *first day* of the *invasion* there are more or less prolonged shiverings, alternating with flushes of heat, and loss of appetite. On the *second day* there is nausea, epigastric tenderness, thirst for cold acidulous drinks, a quick pulse, and hurried respiration. Children are frequently seized with convulsions in this stage. The tongue is loaded with a whitish or yellowish fur, and its point is red. There are pains in the head, back, loins, and limbs. These symptoms continue for *three* or *four days*.

On the *fourth day of the invasion*, the *eruption* appears in small isolated spots on the lips, face, neck, chest, abdomen, and limbs. On the *fifth day* the spots become more numerous, and their summits become *vesiculous*. On the *sixth* and *seventh* days, *vesico-pustular* spots are observable on the skin, and sometimes on the *mucous membrane* of the mouth, pharynx

and eyelids. In the intervals between the pustules, the skin becomes red, and the subjacent parts swollen. On the *eighth day*, the eruption is perfectly pustular, having central indentations. The pustules being more numerous on the face than on other parts, it becomes hot, painful, and tense. *Secondary fever* now comes on, and on the *ninth* and *tenth* days the central indentation disappears, and the pustules become *orbicular* in form. On the *eleventh* and *twelfth* days, the pustules burst, and *desiccation* commences. The crusts or scabs now fall off, those on the hands being detached a day or two later than those on other situations. A thick ropy salivation is established during the more advanced stages of this eruption. After the scabs have fallen off, *circular spots* of a red-brown colour are seen on the skin, and there are always small irregular cicatrices, which sometimes become the seat of furfuraceous desquamation.

In *confluent variola*, all the symptoms are of a more grave type. The cerebral and gastric complications are more intense, there being persisting vomiting, and either delirium or convulsions. These affections may cause the death of the patient before the appearance of the eruption. The eruption, which is commonly *simultaneous*, and seldom *successive*, occurs about the *second* or *third day*, rarely on the fourth, and still more rarely on the fifth.

The pustules are less prominent, and more aggregated, than in simple variola, and their edges run into one another. They are more numerous on the face than other parts; and, in fact, when crusts begin to form, the whole face is covered, as it were, with a mask. This incrustation falls off from about the fifteenth to the twentieth day. Towards the termination of the suppuration, and the commencement of desiccation, some patients fall into a state of coma, and die within twenty-four or thirty-six hours. When the incrustation first falls off, no cicatrices are re-

marked on the skin; furfuraceous scales are, however, soon thrown off, which leave such cicatrices and ulcerations as completely disfigure and alter the expression of the countenance.

During the progress of the disease, pustules are seen in the mouth and pharynx, on the edges of the eyelids, and on the transparent cornea. This structure ulcerates, but is rarely perforated. The cornea frequently remains opaque in its whole extent after this disease.

It is during the secondary fever, which is very violent in the confluent small-pox, that most danger is to be apprehended. Out of 168 deaths, recorded by Dr. Gregory, 27 occurred on the eighth day of the eruption (eleventh day of the disease). Thirty-two died in the first week; 97 in the second, and 21 in the third. In the first week, death seems to be caused by an overwhelming malignancy of the poison oppressing the brain, and causing coma; in the second week from affections of the respiratory passages; and in the third from debility.

Treatment.—When the disease is *distinct* and slight, it will be sufficient to keep the patient in pure air, in a large room, and at a mild temperature, and to open the bowels. The skin may be sponged with tepid water, if its temperature is very high. In the confluent small-pox, the treatment is often not so simple; but requires to be varied to meet the symptoms that arise, just as in fever. Great restlessness, wakefulness and delirium about the eighth or ninth day, are generally benefited by opiates. If the pulse is feeble, broths and wine are required; especially if the pustules do not fill out plumply.

During the *secondary fever*, which generally sets in about the eleventh day of the disease, aperients, opiates, and nourishing diet should be given. Great dyspnœa requires a blister to the chest. The intolerable itching is best allayed by smearing the eruption with cold *cream*.

Various measures have been proposed, in order to prevent the *pitting* and disfigurement occasioned by this horrid disease. Pencilling the pustules with lunar caustic; opening each of them; smearing them with mercurial ointment; keeping the patient in perfect darkness, have each been recommended; but with very doubtful success.

VACCINATION.—The real nature of this excellent means of preventing the small-pox seems to be that it is a kind of small-pox modified and rendered milder by passing through the constitutions of some of the domestic animals. It appears that if the cow be inoculated with small-pox matter, the disease which the animal exhibits in consequence is the same which is familiarly known as the cow-pox, and which, if communicated to the human subject, gives the same amount of protection against a subsequent attack of small-pox, as an attack of that disease would.

As a *general rule*, the exanthemata occur only once during life. But late experience shows that this rule is liable to many exceptions, since there is no kind of exanthema which has not been known to occur twice to the same subject, and this is especially the case with small-pox. The protecting influence, therefore, of vaccination should be renewed at intervals at and after puberty.

RHEUMATISM.—Rheumatism and gout are both *blood diseases*, and therefore should naturally be studied next to fevers. It is an inflammation of a peculiar character, affecting the fibrous structures primarily, but liable to implicate also the serous or synovial membranes in their vicinity. It causes intense pain, and effusion of serum or lymph, but very seldom, if ever, causes suppuration or gangrene.

It generally attacks the fibrous tissue around the *large* joints; and a distinction is to be made between *fibrous* and *synovial* rheumatism. The former attacks the fibrous ligamentous and muscular structures in the

neighbourhood of the joints, without affecting the synovial membranes much; the latter (or *rheumatic gout*, as it is sometimes called) implicates the synovial membrane, greatly causing effusion and considerable swelling of the joints.

Rheumatism may be *acute* or *chronic*. Acute rheumatism is a disease of early life, often affecting children. Its usual *exciting* cause is exposure to wet and cold, combined with muscular fatigue.

The most acute form of acute rheumatism is called *rheumatic fever*. There is a very high degree of fever; full jerking pulse; thickly furred tongue; profuse sour perspiration; scanty and high-coloured urine; depositing a copious lateritious sediment. Together with these constitutional symptoms, there is great pain of several of the larger joints, increased excruciatingly by pressure or motion, and slight redness and swelling. This inflammation is very apt to shift from joint to joint (by *metastasis*, as it is technically called), and most especially it is liable to attack the pericardium, and the lining membrane of the heart.

Treatment.—If the patient is young and robust, and the fever very violent, venesection may be employed; if employed, it should be done *early;* a repetition of bleeding is not well borne, although the blood is buffed to the last; and too much bleeding is apt to induce metastasis to the heart.

The next remedy deserving of notice is that which is commonly known as Dr. Chambers's plan of treatment, and which consists in producing a large flow of motions from the liver and intestines. Five or ten grains of calomel are given at bed-time every other night, and followed in the morning with a black draught; and this is repeated twice or thrice till a copious secretion has been produced from the liver and intestines. After this, diuretics and colchicum, alkalis, *diuretics, and* calomel and opium may be administered

tered in conjunction, with almost equal claims on our confidence.

Chronic Rheumatism is, as Dr. Elliotson pointed out, of two kinds. One has a nearer affinity to the acute; it is aggravated by heat and stimulants, and is best treated by clearing out the liver, and securing a free action of the kidneys and skin; at the same time taking care that the diet consist of nutritious and digestible substances, not disposed to acidity.

The iodide of potassium is also extremely serviceable in these cases of *subacute* rheumatism, in doses of three grains ter die, with an alkali and a bitter. It causes a great flow of urine in which it may be detected by the proper tests.

The other variety, which is very common in elderly people, is benefited by stimulants, especially by warmth, friction, ammoniated tincture of guaiacum, &c.

GOUT. — Gout is a constitutional disease, characterized by a superabundance of lithic acid in the system, which is deposited from the urine, and concretes around the joints in the form of what are called *chalk-stones;* which really consist of lithate of soda.

Gout is generally a disease of advanced life, and seldom occurs till after puberty. It is liable to be brought on by sedentary habits, and indulgence in animal food and wine or malt liquors.

It presents many resemblances to rheumatism, but differs in the following points: — 1. Rheumatism affects chiefly the young and middle-aged; gout, the elderly. 2. Rheumatism prefers the larger joints; gout, the smaller, and especially the feet and hands. 3. Gout is attended with more obvious disorder of the digestive organs; the pain is of a more burning character, and the swelling greater and more vividly red.

Symptoms.—After suffering some time from premonitory symptoms, such as irritability of temper, loss

of appetite, and various anomalous aches and pains, there comes on often (suddenly in the night) a very severe burning, aching, wrenching pain in the ball of the great toe, or some other joint of the hand or foot; at the same time there is shivering, followed by feverish heat, thirst, foul tongue, scanty urine depositing lithic acid, and confined bowels. The pain usually remits towards morning, but occurs again for several days, till the fit is over, and then the cuticle of the inflamed part desquamates, with violent itching.

Without great care, another fit comes after some months; and the disease becomes established in paroxysms, till at last in some cases the disorder becomes *chronic* and *habitual*. The joints affected return to their usual pliability after the first few attacks, but gradually become stiff and crippled, and deposits of *lithate of soda* are formed in the cellular tissue.

Gouty people are also liable to inflammations of the eye, lungs, and other parts, which are very stubborn when treated with common remedies, but yield generally to colchicum. Inflammation of the stomach, brain, or other internal organs, sometimes takes place, and carries off the patient most rapidly, if not actively treated.

Treatment during an acute attack.—The indications are to free the system from superabundance of lithic acid by low diet, and increasing the secretions, and to allay pain.

The first point is to act well on the bowels by calomel, followed by rhubarb draught, and any other warm purgative. The diet should be merely tea and toast, water-gruel, &c. The affected part should be bathed frequently in tepid water. Then colchicum may be given combined with alkaline diuretics or diaphoretics. The patient should not be weakened by too much purging.

For the *chronic gout*, the great points are to improve *the tone of the digestive* organs, open the bowels, and

keep up the strength without heating the system. The iodide of potassium in doses of gr. ij ter die with a light bitter infusion; the dec aloes c. with sodæ carb.; or *Gregory's powder* of rhubarb, magnesia, and ginger, as regular aperients, are generally useful.

For sudden attacks of gout in the stomach, heart, &c., the indications are to put the feet in hot mustard and water, to apply mustard poultices to the epigastrium; and give æther and sal volatile if there is much collapse, and afterwards a warm antacid aperient. As soon as the symptoms permit, a dose of calomel and opium, followed by rhubarb, magnesia, and sal volatile, may perhaps remove offending matter from the stomach and bowels which has been a determining cause of the attack.

The *sulphate of manganese*, in doses from one scruple to a drachm, has lately been given in gout, and other disorders attended with insufficient secretion of bile. It produces a copious flow of bile.

DISEASES

OF THE NERVOUS SYSTEM

AND

ITS APPENDAGES.

HYDROCEPHALUS (ACUTE).

Hydrocephalus signifies merely *dropsy of the brain;* the disease which it is used to designate is, however, an acute inflammation of the brain and its membranes, often ending in serous effusion.

Predisposing causes.—The *epochs of infancy and childhood* may be called predisposing causes, especially when combined with a scrofulous diathesis.

The *exciting causes* are, external injuries from blows, falls, &c., concussions of the brain, from whirling or tossing the child; the suppression of eruptions on the scalp, and behind the ears; the extension of inflammation from the ear; the retrocession of acute eruptions, and suppression of chronic discharges; the extension of irritation to the membranes of the brain, from inflammation of the pharynx, scalp, face, &c.; too copious depletion in exanthematous or other diseases; metastasis of various affections; the too free use of narcotics in young children, &c.

This disease has usually been divided into *periods,* or *stages.*—1st, the stage of increased sensibility; 2nd, that of diminished sensibility; and, 3rd, that with palsy or convulsions.

Symptoms: First stage.—After the existence of precursory *signs, for* a variable period, the child is attacked *with* headache, confined to the forehead or

temples; the pulse becomes quick and hard; the skin hot and dry; and the bowels obstinately constipated. The tongue is loaded or furred; the stomach is exceedingly irritable, vomiting being frequently produced on the child changing its position; and the urine is scanty and thick. The temperature of the head is much increased; the pupils are contracted; the brows are knit; there is an inability to sit up, and a whining or moaning noise when the child is lying down. The sleep is short and disturbed: the patient rolls its head on the pillow, or often wakens with a scream, or crying, and raises its hands to its head. Sometimes the attack begins by convulsions.

Second stage.—The sensibility is now remarkably impaired; the drowsiness increases in degree; the pupils are dilated, and there is strabismus, and imperfect or double vision; the eyes are dull, heavy, vacant, or staring; the eyelids drooping or half closed. The pulse, from being frequent, now becomes slow, and sometimes even more so than natural, when the patient is in the horizontal position; but if he attempts to sit up, it immediately acquires its former rapidity. Slight convulsions show themselves in momentary attacks in the eyes, mouth, or upper extremities, which are tremulous. The hands either are raised to the head, or the child picks its nose or mouth. The stupor is occasionally interrupted by loud and shrill screams from the child; and partial contractions of some of the limbs begin to manifest themselves.

Third stage.—The last stage now comes on; the pulse is quick, thready, and weak; there are partial or general convulsions; and paralysis of one side or limb occurs. The pupils become more and more dilated, the eyes suffused, and the cornea dull and filmy. The patient is either comatose or delirious, rolls his head about on the pillow, grinds his teeth, and moans or breathes heavily and quickly. The skin becomes cold and covered with perspiration, or the

sweating may be partial; the respiration is irregular, or stertorous. The excretions are passed involuntarily, and the patient generally dies in a brief convulsive fit.

Morbid appearances. — Inflammation of the pia mater, most commonly observable at the base of the brain, around and in the fissures of Sylvius. The cerebral substance is generally engorged, and the central white parts of the brain are more or less softened. The lateral ventricles frequently contain from four to six ounces of fluid. The most common complication of hydrocephalus is, tubercle of the nervous substance, which, amongst the poorer classes, occurs nearly in one-third of the cases. Tubercular deposits are also found in various other parts of the body, in a vast majority of cases.

Treatment.—This should be antiphlogistic in the early stage. Below the age of five, it will be more prudent to apply leeches to the temples or behind the ears than to bleed generally. But some physicians deem it right to abstract blood from the arm, even in children of three or four years of age. The abstraction of blood must be followed up by free purging; and as the bowels are always constipated, recourse must be had to the most active purgatives, especially calomel and scammony; in many cases, the administration of croton oil will be found necessary to obtain evacuation of the bowels. During the employment of these means, the head should be shaved, and kept cool by the constant application of cold lotions. Calomel may be administered in small regular doses, till it causes green stools like chopped spinach. Great excitement or delirium may be mitigated by giving very small doses of tartar emetic in solution. When the force of the circulation and the acuteness of the disease have diminished, blisters may be applied to the nape of the neck. In the later stages, digitalis, colchicum, and a variety of remedies have been recommended, but the case is almost beyond relief. There is, however, a

combination of equal parts of crude mercury and fresh squills, rolled into a mass, which may be given in doses of five grains *ter die;* it causes a great secretion of urine.

Cerebral exhaustion in children produces many symptoms like hydrocephalus, for which it would be most dangerous to mistake it, as the causes, nature, and treatment are quite opposite. It occurs to children ill-fed, or exhausted by depletion: the face is cool; the child very drowsy, and unable to hold its head up: the breathing irregular and sighing. One grand distinctive mark is, that the *fontanelle is sunken*, showing that there is no vascular turgescence in the brain. Beef-tea, small doses of ammonia, good nursing, and warmth, are the remedies.

Chronic Hydrocephalus.—In this form the symptoms are similar, but are more of a sub-acute character.

Treatment.—There are only two modes of treatment worth mentioning: viz., gradual compression of the head, and puncture. The former method, which was well known to the physicians of the seventeenth and eighteenth centuries, has been recently revived by Sir Gilbert Blane; while the happy results of puncture, through the anterior fontanelle, in the hands of Dr. Conquest, sufficiently justify us in having recourse to this operation as a probable means of cure. Compression should be well kept up after the operations.

ENCEPHALITIS (*Inflammation of the brain*).—*Causes.*—Long exposure to a vertical sun, anxiety of mind, the inordinate use of ardent spirits, cold, fright, external injury, the sudden disappearance of an old discharge, &c., may produce this disease; it sometimes occurs as consequent on small-pox, or erysipelas of the face and scalp, and fevers, especially those of typhoid character, &c.

Symptoms.—Violent inflammatory fever, hot and dry skin, flushed countenance, suffused eyes, quick and hard pulse, throbbing of the carotids, and delir-

ium. The senses are morbidly acute, there being intolerance of light and sound. The person is extremely restless; there is jactitation of the limbs, and rigidity of the muscles; the head is remarkably hot, the pupils contracted, and the excretions and secretions are suppressed. Occasionally, the muscles of the face are spasmodically affected, the upper eyelid hangs down, and the commissures of the lips seem to be drawn to one side. The tongue is white, loaded, red at its edges, and the papillæ elevated; there are nausea and vomiting, and obstinate constipation of the bowels. This last symptom is common in congestion or inflammatory affections of the brain.

As the disease advances, all these symptoms are reversed; the morbid acuteness of the sensations changes into blindness and deafness; the delirium passes into stupor, and gradually into coma. Convulsions and different forms of paralysis ensue; the countenance is vacant or idiotic; the eye loses its lustre, the pupils become dilated; and occasionally there is strabismus. The respiration is now irregular, occasionally stertorous, the articulation imperfect, the pulse frequent and small, the limbs spasmodically convulsed or paralytic; there is retention of urine, and involuntary discharge of the fæces. In the still more advanced stage the countenance becomes pale and sunken, the pulse weak and irregular, the urine passes off involuntarily, the skin becomes cold and clammy, the coma more profound, and death soon closes the scene.

Morbid appearances.—The inflamed part of the brain presents different appearances, according to the time the disease has lasted. When it is only of some days' duration, the white substance, and still more perceptibly, the grey, exhibit a rosy, or slight red colour; and in it we perceive several vascular filaments. The firmness of the affected part is considerably diminished, *and when cut into, the* surface of the incision presents

a number of small red points, which cannot be removed by ablution.* In a more advanced stage of encephalitis, the brain is red, the vascular injection more strongly marked, and the softening very considerable. Finally, in some cases, the blood becomes so intimately mixed with the cerebral substance, that its colour approaches that of the lees of wine, being of a deep dusky red; there is no actual effusion of blood, except we consider as such some small dots, about the size of a pin's head, which we occasionally find in some particular points; in such cases, the brain is in a state of extreme *ramollissement*.

Should it happen that the inflammation passes into these stages without causing death, then the part affected begins gradually to lose its softness, and ultimately becomes more dense than in the natural state; it retains for some time its red colour, but finally changes to a dusky yellow.

The third stage of encephalitis is that of suppuration; the red colour gradually disappears, and the blood is replaced by a sero-purulent fluid, which is infiltrated into the substance of the brain, combines with it, and gives to it, according to the extent of the admixture, a greyish, dull white, or yellowish green colour. Sometimes the pus is found in small isolated spots; at other times small distinct cavities form, and occasionally we find several small cavities uniting to form a large one. In some instances, the pus is found enclosed in cysts, in which case the purulent matter assumes the same characters as that found in the cellular membrane of the body. The grey substance is the most usual seat of encephalitis; and the part most commonly affected are, the corpora striata, optic thalami, the convolutions, pons Varolii, and cerebellum.

* These small red spots differ from those of congestion which small drops of blood reappear, as soon as they are wiped away.

Treatment.—In this case, the most active treatment must be had recourse to. The patient should be bled to the approach of syncope; the head should be shaved, and leeches applied to the scalp, or cupping to the nape of the neck, and these remedies must be followed by those usually practised in all inflammatory diseases.

DELIRIUM TREMENS (*Delirium c. tremore*).—The *brain fever of drunkards* (Armstrong) is variously modified, according to the causes in which it originates, and the habits and constitution of the patient.

Symptoms.—The phenomena of this disease vary remarkably, from the slightest forms of nervous tremor, with spectral illusions and accelerated pulse, to the most alarming state of vital depression, muscular agitation and mental alienation. In ordinary cases, it is characterized by constant watchfulness, and tremulous quivering motion in the lips, hands, and muscles generally, on making any effort. The pulse, which is at first slow, becomes quick; there is a constant disposition to talk, now on one subject, and now on another. In some cases, the pulse is full and hard, the skin dry, the delirium furious, the eyes injected, the temperature of the head increased, and the tongue is often dry, and red at its edges. In others, and the most common, the pulse is small, or soft, and ranges between 100 and 120; the face is not flushed, nor the skin hot, but is covered with a clammy perspiration. As the disease advances, the patient is perpetually haunted by frightful creatures, or occupied with the most extravagant ideas, and is continually endeavouring to avoid them. If a favourable change do not now take place, the skin becomes more cold and clammy, and exhales a peculiar smell, which is, as Dr. Hodgkin has remarked, between a vinous and alliaceous odour; the pulse becomes still more frequent, small, weak, and thready, so that it cannot, in some cases, be counted; the general tremor increases; the patient

talks incessantly, and with great rapidity; the delirium increases, and the patient either sinks into the calm which sometimes precedes death, or is carried off in a convulsive effort.

Morbid appearances.—These are nearly confined to a congested state of the veins of the pia mater and brain. The appearance of the *stomach* and *liver* are not necessarily connected with the pathology of this disease.

Treatment.—Opium is the only remedy to be depended on in this disease; it should be administered in large doses, and repeated until sleep supervenes. The preparations of morphia are to be preferred. Depletion should not be attempted. Cold affusion on the head is useful.

APOPLEXY.—This affection is characterized by loss of consciousness, feeling, and voluntary motion; or, in other words, by a suspension of the functions of the brain, respiration and circulation being also more or less disturbed.

The suspension of the cerebral functions may be connected with any of the following pathological conditions:—1. Great congestion of the brain, in which the vessels of that organ are gorged, but without extravasation of blood or serum; this is termed "*congestive apoplexy.*" 2. Congestion of the vessels of the brain, with extravasation on its surface, forming the "*meningeal apoplexy*" of Serres. 3. Hæmorrhage into the substance of the brain, with lesion of its structure. 4. A serous effusion on the external surface, and into the ventricles of the brain, constituting what is defined "*serous apoplexy.*" 5. Apoplexy may occasion death without leaving any sign at all in the dead body. To this variety, to which the older writers gave the names *nervous, convulsive,* and *hysteric,* Dr. Abercrombie has applied the term *simple apoplexy.*

Causes.—Apoplexy is said to be hereditary. It may occur at an early period of life, but in the majo-

rity of cases the age is above fifty. Among the causes of apoplexy are—ossification or aneurism of the arteries of the brain; obstruction, thickening, induration, or obliteration of the canals of the sinuses; diseases of the heart, especially hypertrophy of its left ventricle; diseases of the kidney, particularly the granular degeneration described by Dr. Bright; torpor of the liver, or other excreting glands; diseases of the air-tubes and lungs, especially those attended with violent fits of coughing; the *coup de soleil;* suppressed hæmorrhages, particularly epistaxis and hæmorrhoids; suppression of the menstrual discharge; metastatic gout and rheumatism; suppression of any vicarious discharge; depressed and anxious states of the mind; excessive use of wine or malt liquors; too great sexual indulgence; frequent indulgence in sleep after a full meal; the use of neckcloths worn too tightly round the neck, &c., are among the predisposing causes to apoplexy. Gastric disease, narcotics, and mephitic gases may also be enumerated. Overloading the stomach and neglecting the bowels are often enough to cause an attack in the predisposed.

Apoplexy is said to occur chiefly in persons of a full habit of body. Upon this point, M. Rochoux's cases afford important data. Of his sixty-three patients, thirty were of an ordinary habit of body, twenty-three were of a thin, meagre habit, and ten only were large, plethoric, and fat.*

Symptoms (*premonitory*).—Apoplexy is sometimes preceded at considerable intervals by precursory or warning symptoms, such as vertigo, headache, ringing in the ears, loss of memory, a feeling of drowsiness and lethargy, depraved vision, or partial palsy. In some cases, there is a sense of great fulness in the head, the veins of the head and forehead become turgid, the countenance is suffused and occasionally

* *Récherches* sur l'Apoplexie, p. 214.

livid, and there are slight attacks of epistaxis. It is a serious error to suppose that premonitory symptoms always occur; indeed, if we may trust the experience of M. Rochoux, one of the best authorities on apoplexy, they are by no means common. Of *sixty-three cases* which came under his notice, *nine* only had distinct precursory symptoms.*

Symptoms of the attack.—In the *mild* form of apoplexy (the *atonic* apoplexy of Dr. Good), the patient, after experiencing some of the premonitory symptoms, is seized with alarming vertigo, leipothymia, or feeling of faintness; nausea and vomiting; disturbance of the senses, particularly of the sense of sight; loss of memory; partial loss of sense, consciousness, speech, and voluntary motion; weak, irregular, and sometimes quick pulse, and more or less of sopor.

In the *more active form* (the *entonic* apoplexy of Dr. Good), the patient is more or less suddenly seized with profound sopor, the eyes being either open or closed; the breathing deep, slow, sonorous, or stertorous; and the pulse slow, full, hard, or strong, sometimes irregular. In this form of the disease, the above are often the chief symptoms, there being no paralysis; but frequently the mouth is drawn to one side, the eyes are distorted, and one eyelid immovable, with relaxation, loss of sensation and of motion of a limb, or of one side of the body; the arm of the non-paralysed side being often closely applied to the chest or to the genital organs. The patient generally lies on the paralysed side, which is relaxed, incapable of motion, and insensible to the application of irritants.

In the *most severe and sudden* forms of attack, the patient is struck down instantly, sometimes froths at the mouth, has a livid countenance, dilated pupil, complete relaxation and immobility of the voluntary muscles and limbs, and unconscious evacuation of the

* Loco citato, p. 70.

urine and fæces, and dies very shortly afterwards either with or without stertor, with cold, livid extremities, cold perspiration, and sometimes a cadaverous cast of countenance. This form constitutes the *apoplexie foudroyante* of the French, in which there is generally an immense extravasation of blood.

Duration of the symptoms in fatal cases of apoplexy.—According to the common opinion, apoplexy may prove fatal instantly or in a few minutes. In some cases, on the other hand, patients remain even for months in a comatose, paralytic state.

Of serous apoplexy.—It was once supposed, in certain cases not attended with evidence of vascular excitement, the symptoms were owing to an *effusion of serum;* hence they were called serous apoplexy; but this distinction is now abandoned.

Diagnosis between serous and sanguineous apoplexies.—The sanguineous was said to be distinguished by flushing of the countenance, and strong pulse, and by occurring in persons in the vigour of life; the serous, on the other hand, was said to attack the aged and infirm, the countenance being pale, and the pulse weak, in such cases. But there are many cases whose symptoms and circumstances come exactly within the description of the *serous apoplexy,* but still after death present the vascular engorgement, &c., of the sanguineous, whilst no serous fluid is effused. Speaking of these distinctions, Dr. Abercrombie observes, "it will be found that many of the cases which terminate by serous effusion, exhibit in the early stages all the symptoms which have been assigned to the sanguineous apoplexy; while many of the cases which are accompanied by paleness of the countenance and feebleness of the pulse will be found to be purely sanguineous."

Morbid Appearances.—Effusion of blood within the cranium may take place in the brain or cerebellum; in the crura; in the pons Varolii, and in the medulla oblongata; in the corpus callosum; in the ventricles;

on the surface of the brain beneath the pia mater; in the cavity of the arachnoid; between this membrane and the dura mater, which it lines; and between the dura mater and cranium.

Treatment.—In the treatment of apoplexy, the first indications are to relieve the head from the accumulation of blood, to prevent further congestion, and to obviate inflammatory action; and for these purposes the only efficient means is *bleeding*. A full bleeding, then, must be immediately applied; the head should be shaved and freely leeched, and the patient may be cupped on the temples or the back of the neck. The administration of brisk *drastic cathartics* is attended with the best results, their *derivative* action being a powerful means of relieving the coma. Croton oil is the purgative oil generally used in these cases; but where the patient can swallow, other drastic cathartics may be given. Where the patient has completely lost the power of deglutition, the croton oil should be mixed with a little castor oil or mucilage, and passed into the œsophagus by means of an elastic tube. Drastic *enemata* will also be found beneficial. The head must be kept cool by means of *cold lotions*, *iced waters*, or by pouring a small stream of cold water on the scalp occasionally. When the coma is persistent, *blisters* should be applied to the nape of the neck, or to the head; sinapisms to the feet are also indicated. But it must yet be remembered that there is a certain injury done to the brain; that a portion of its substance has been torn up, and compressed by a clot of blood; and that a certain amount of injury has to be repaired. Hence, indiscriminate use of the lancet, draining the patient's veins after all active congestion has ceased, is much to be reprobated. Something must be allowed to time, and the powers of nature.

If the patient's face is cold, the carotids beating feebly, and the patient approaching a state of syncope, considerable caution must be used in abstracting

blood. Purgatives should first be given, with small doses of ammonia, and sinapisms be applied to the feet —when the circulation has recovered its force, blood may be taken by cupping from the nape of the neck, and blisters be applied behind the ears, or to the nape of the neck.

When an attack of apoplexy is known to follow habitually, if the stomach is loaded with indigestible food, an emetic of sulphate of zinc may be given, as it evacuates the stomach with the least possible straining.

PARALYSIS.—The most characteristic symptom of cerebral hæmorrhage is paralysis. Very slight effusion produces this effect, and in general its intensity is in the direct ratio of the extent of the effusion. Paralysis may also arise from diseases of the brain or its membranes, injuries of the brain or the spinal cord, diseases of the spinal cord or its membranes, pressure on, or injury of, the large nervous plexuses, the action of lead, &c.

Paralysis has been divided into several varieties :— 1st, paralysis of the nerves of motion; 2nd, paralysis of the nerves of sensation; 3rd, *hemiplegia*, which implies the existence of paralysis in one side of the body; 4th, *paraplegia*, which signifies that the lower extremities are paralysed; and 5th, *partial* paralysis, as of the muscles of the mouth or an extremity; 6th, *general* paralysis, when the two sides of the body, whether in their entire extent or in some of their parts, are at once deprived of motion.

PARALYSIS FROM CEREBRAL HÆMORRHAGE.—This form of paralysis developes itself at the very moment the effusion of blood takes place in ordinary apoplexy; acquires all at once its highest degree of intensity; then remains stationary, or begins to diminish. Sometimes the paralysed part had not previously experienced any disturbance with respect to either sensation or motion; sometimes, *on the* contrary, the patient had experienced *in these parts* pricking sensations, numbness,

permanent or transient, an unusual feeling of cold, a sense of weight, and a certain degree of debility.

The paralysis following cerebral hæmorrhage presents great varieties with respect to its seat, and pathological anatomy is far indeed from being always able to assign the cause of such numerous varieties.

There has not as yet been established any *special* relation between the seat of the effused blood and the paralysis of particular organs.

It has been asserted that *loss of speech* depends on the effusion occupying the *anterior lobes* of the brain; but this observation derives still less support from actual experience than the former, for *blood may be effused in the anterior lobes* of the brain *without giving rise to any modification of speech.*

The best established facts regarding the seat of cerebral hæmorrhage, and the relation which exists between it and paralysis, are the following:—1. That the paralysis almost always occupies the side of the body opposite to that of the brain or cerebellum in which the effused blood is situated. 2. That the paralysis affects only one side of the body when the effused blood is confined to one hemisphere of the brain, or one of the lateral lobes of the cerebellum. 3. That the paralysis exists on both sides of the body when the hæmorrhage has taken place in both hemispheres of the brain, or both lateral lobes of the cerebellum, into the ventricles, the pons Varolii, the medulla oblongata, and on the surface of the brain. 4. That paralysis of both sides of the body may also take place when the hæmorrhage is confined to one hemisphere of the brain or lateral lobe of the cerebellum, but is so extensive as to produce compression of the opposite hemisphere or lobe.

Treatment.—The treatment of paralysis dependent on cerebral hæmorrhage consists at first in the treatment proper for the different varieties of apoplexy; and afterwards in the use of derivatives, and finally, general and local stimulants. When the organic

disease of the brain is removed, and all symptoms of vascular excitement or congestion have disappeared, we may have recourse to *strychnia*.

The *local treatment* consists in rubbing the parts with stimulating liniments, so as to produce absorption of the effused fluid, applying blisters to the spine, or along the course of the nerves, sprinkling the abraded surface with strychnia, and, finally in using electricity. The use of the moxa has been strongly recommended; if the paralysis exist in the lower extremity, it may be applied in the course of the great sciatic nerve; if in the upper extremity, it may be applied to the back of the neck, corresponding to the junction of the brachial nerves with the spinal cord.

EPILEPSY.—*Causes.*—Epilepsy appears to be occasionally hereditary, but it is more frequently an acquired disease. It generally arises from excessive nervous irritation, either induced by sympathetic influences, or by direct causes. As examples of the former, are gastro-intestinal disturbance, from indigestible food, worms, &c.; difficult dentition; uterine irritation; excessive sexual intercourse, and masturbation; the abuse of spirituous and fermented liquors; the presence of calculi in the kidney, ureter, or bladder, or of gall-stones in the excretory duct of the liver. The direct causes are—injuries of the head or spine; diseases of the cranial bones or of the vertebræ; tumours growing on the bones, or spicula of bone protrudingi nto the brain; ossific depositions in the dura mater or its processes; ossification of the arteries of the brain; concussions of the brain or spinal cord; and metastasis of gout or rheumatism to the encephalon. The other causes which have been enumerated are—fright, fits of passion, distress of mind, appalling sights, seeing others in the paroxysm, excessive hæmorrhage, immoderate depletion, hypercatharsis, the suppression of eruptions, irritation of remote nerves, *and the syphilitic* and mercurial poisons. Its causes

may be divided into, 1st, the *centric*, consisting of disease, or causes of irritation in the nervous centres; 2nd, the *excentric* or *peripheral*, consisting in causes of irritation in the viscera or external parts.

Symptoms.—Epilepsy is generally a chronic disease, and frequently ends in insanity; it sometimes, however, proves fatal during a paroxysm. It consists in fits of *unconsciousness* and *convulsions*. The epileptic fit is *occasionally preceded by certain warnings*, such as stupor, a sense of coldness, or creeping, or of a gentle breeze (*aura epileptica*) proceeding from a particular part of the body towards the head. M. Georget states, "that warnings do not occur in more than five cases in a hundred;" this is, however, underrating their frequency.

In most cases, the patient utters a cry, and suddenly falls senseless; the eyes are opened widely, the pupils are fixed, the face is drawn to one side, and the jaws are firmly closed; after some minutes, the muscles of the neck become rigid, the jugular veins distended, and the face is in a state of livid turgescence; the muscles of the face are now seized with frequent spasmodic contractions; there are convulsive movements of the extremities, particularly the superior; the thorax is fixed, and the respiration is exceedingly difficult. The tongue is sometimes thrust with violence out of the mouth, and is occasionally caught between the teeth, and severely bitten; in this case, the frothy matter expelled from the mouth is tinged with blood. To this state, which may last from a few minutes to a quarter or even half an hour, succeeds a deep sleep, general relaxation of the muscular system, paleness of the countenance, and a gradual return of free respiration; the countenance for some time retains an expression of stupidity; the intellectual and sensitive faculties, however, gradually resume their activity, the patient at the same time experiencing a creeping sensation all over his body. Occasionally it happens that one fit

succeeds another, till the patient becomes comatose, and dies; but comparatively few die during a fit, unless the disease has existed for a considerable time. In some cases, the attack is much less violent, and consists merely of a momentary loss of sense, with slight and partial convulsions of the eyes, mouth, upper extremities, or fingers, and may or may not be accompanied by a fall.

The most frequent *complications* of epilepsy are, apoplexy, mania, paralysis, chorea, hysteria, and catalepsy; hence the morbid appearances are infinitely various.

Morbid Appearances.—Epilepsy may be connected with any of the organic lesions which occur in the brain and cranium. When a patient dies in a fit of simple epilepsy, the substance and the membranes of the cerebrum and cerebellum are found gorged with black blood. In complicated cases of epilepsy, especially with mania, the medullary substance of the brain is found indurated, and its vessels enlarged; occasionally, however, with dilatation of its vessels, it is softened and flabby. These structural changes are generally limited in extent. In many cases no morbid appearances are to be discovered.

Treatment.—But little can be done for the patient during the paroxysm, except placing him in the horizontal position, and preventing his being injured by the violence of his muscular exertions. One of the first things to be done is to put something between the teeth, to prevent injury to the tongue, and the dress must be loosened, particularly stays and neck-cloths. *Bloodletting* as a rule should not be practised. *Cold affusion* to the head has been recommended by Brera; it is not very efficacious, except in those cases complicated either with hysteria or uterine disease. *Antispasmodic* and *purgative enemata* are perhaps the most efficacious means during the fit; if there be not much determination to the head, assafœtida *injection and castor oil* may be employed; but when

this symptom is present, turpentine should be preferred.

After the paroxysm is over, the patient should be kept quiet, the bowels opened as quickly as possible, and light nourishing diet in moderate quantity is to be used; the abuse of stimulants is to be abstained from; and every cause, corporeal as well as mental, which can possibly have the effect of disturbing the balance of the circulation, or exciting the nervous system, is to be avoided. In some cases associated with deficient power, whilst moderate local depletion, dry cupping, external derivation, &c., are resorted to, *tonics* and *antispasmodics*, such as valerian, castor, myrrh, cinchona, camphor, and the preparations of iron, should be prescribed. Where epilepsy occurs in a scrofulous habit, the ioduret of iron or the iodide of potassium may be given. If worms be suspected, turpentine and other anthelmintics must be exhibited. The diseases of the digestive organs, and the other complications of epilepsy, should be treated on general principles.

Some medicines have been much lauded in the treatment of epilepsy; the principal of these are—the nitrate or oxyde of silver, the ammonio-sulphate of copper, arsenite of potash, sulphates of iron, zinc, or copper, quinine, extract of nux-vomica, and strychnia. Among the antispasmodics employed are, æther, ammonia, camphor, musk, castor, assafœtida, galbanum, valerian, and sepentary.

CHOREA.—This disease is popularly named St. Vitus's dance, *Chorea Sancti Viti;* the French call it the dance of St. Guy; and the Germans, the dance of St. Weit.

Causes.—The most common are, intestinal irritation from worms or morbid accumulations, and fright. It may also be caused by injuries to the nervous system from blows or falls; by suppression of eruptions, or vicarious discharges; by rheumatic metastasis to the

membranes of the spinal cord; by violent mental emotions; by excessive venery; by masturbation, &c.

Symptoms.—Generally speaking, convulsive movements, or rather twitches, of the fingers and muscles of the face are first observed; after a short time, the convulsive movements become more marked; strange contortions of the features take place; the disease extends to the voluntary muscles of all parts of the body, and frequently those of the lower extremities are so continually excited that the patient appears to be dancing, which makes his gait very unsteady; he is chiefly affected when he is most desirous to control his actions. The disease is sometimes confined to one side of the body, or it is more perceptible on one side than the other; the muscles are also affected with a sensation of pricking, creeping, or of numbness. At first there is no constitutional derangement, there being no fever, and all the functions being properly performed, with the exception of the bowels being torpid; but after the disease has continued some time, the general health becomes impaired, and occasionally the mental faculties suffer. This affection is much more common in the female than the male, the proportion being, according to the best authorities, three of the former to one of the latter. It most frequently appears between the age of seven and fifteen.

The *nature of the disease* is but very little understood; by several writers it is attributed to inflammatory action of some part of the cerebro-spinal axis; and Dr. Hamilton ascribed it to the disordered functions of the bowels affecting the muscular actions sympathetically.

The *seat* of this disease is quite as obscure as its nature. M. Serres considers the *corpora quadrigemina* to be the seat of chorea, while MM. Bouilland and Magendie conceive that it is seated in the cerebellum, *the functions which* they ascribe to this organ being

those chiefly affected in this disease; it is, however, much more probable that the affection depends on disturbed function of the nerves arising from the spinal marrow.

Treatment.—This consists in removing morbid secretions and fæcal accumulations; in subduing, when evidently present, excited action of the vessels of the spinal cord or brain; and, finally, in rousing the energy of the organic nervous system. *Purgative medicines* have been prescribed with the best effects in this disease; a full dose of calomel should be given at first, and in a few hours after a brisk cathartic ought to be exhibited. Calomel and jalap are a common combination in this disease; and Dr. Hamilton recommends aloetic pills on the days when these are not employed. The compound infusions of gentian and senna, with a little sulphate of magnesia, may be given in the morning occasionally. The oil of turpentine also forms an excellent medicine in chorea, and is particularly indicated where the presence of worms is suspected. The diet should be light and nourishing; every indigestible substance should be carefully avoided.

If there be evidence of cerebro-spinal irritation, our attention must necessarily be directed to its removal; this is best effected by cupping, leeches, and powerful counter-irritation, over the parts particularly implicated. Attention to the mental emotions, warm woollen clothing on the lower extremities, cold affusion on the head or on the spine, or the shower-bath, constitute important parts of the treatment.

Boys are said to be more easily cured than girls. In obstinate cases, tonics must be employed, and those generally used in this disease are, bark, disulphate of quinine, arsenical solution, nitrate of silver, sulphate of zinc, the preparations of iron, and the ammonio-sulphate of copper.

HYSTERIA.—This is an apyrexial convulsive dis-

order, affecting females almost exclusively. The seat of this disease is altogether unknown.

Symptoms.—Hysteria is an intermittent, irregular, chronic disease, which comes on by fits, and usually attacks females from the age of puberty to the critical period; it very commonly occurs on the suppression or diminution of the menses, particularly in persons of a nervous or irritable temperament. In the slighter forms, the patient, without any assignable cause, bursts into a fit of weeping, which perhaps is soon followed by convulsive laughter, which may last for a few minutes; and before composure takes place, the patient gives several loud sobs; one of these fits may succeed the other, till the patient falls asleep. The fit sometimes begins with a yawning, numbness of the extremities, involuntary laughing and crying, alternations of pallor and redness of the face, and a sensation as if a ball (*globus hystericus*), commencing at the hypogastrium, ascended through the abdomen and thorax to settle at the throat, where it produces a violent sense of constriction, and of impending suffocation. In more severe instances of hysteria, there are convulsive movements, particularly of the hands, face, jaws, and muscles of respiration; they are of a clonic class. The pupils are dilated; and occasionally the paroxysm has a close resemblance to epilepsy, only that the insensibility is rarely complete. In this disease there is a remarkable deficiency of the organic matters in the urine, and this fluid is very watery. Hysteria does not tend essentially to increase, nor does it determine, as a consequence, mania or idiotcy.

Treatment.—In those cases where there is reason to suspect any congestion or inflammation of the uterus, or of any portion of the brain, then blood should be drawn by cupping from the back of the head or loins. During a paroxysm, the stays and all tight strings should be loosened, and the free admission of air procured; the face is to be sprinkled with cold water,

volatile salts are to be held to the nostrils, and, if the patient can swallow, a drachm of the aromatic spirit of ammonia, or the same quantity of ammoniated tincture of valerian, may be given in a wineglass-full of water. In the severer forms of the disease, the application of cold to the body is often a most effectual means of putting a stop to the paroxysm. The bowels should be kept regularly open, and the best purge in these cases is castor oil with oil of turpentine, given every, or every second morning, according to circumstances; enemata containing assafœtida are also useful. The prevention of the recurrence of the symptoms is to be attempted by keeping up an action on the bowels, and administering tonics, such as the disulphate of quinine, the preparations of iron, &c. Fœtids, such as assafœtida, castor, valerian, &c., are sometimes, but not invariably, useful. The menstrual action, if irregular, must, if possible, be rectified by appropriate means. The diet should be light, and every attention paid to the improvement of the general health.

Catalepsy.—In this form of hysteria the patient remains in the same position during the attack, which may last from a few minutes to even two days. The treatment is the same as the preceding.

DISEASES

OF THE

AIR-TUBES, LUNGS, AND HEART.

AFFECTIONS OF THE AIR-TUBES.

ANGINA LARYNGEA, (*Laryngitis.*)

(Inflammation of the lining membrane of the larynx.)

Symptoms.—Acute laryngitis may vary from the production of but a slight hoarseness, without stridulous breathing, and with but little or no fever, to a violent irritation of the mucous membrane and subjacent cellular tissue of the glottis, epiglottis, and upper portion of the larynx, which, by inducing œdema, may cause death by suffocation. The developed stage of this disease is generally preceded by a sensation of irritation, heat, and tickling in the throat, pain in the region of the larynx, increased by pressure, and cough. General febrile excitement comes on, the respiration is stridulous, the voice becomes hoarse, sometimes descends into a whisper, and in extreme cases there is complete aphonia. Violent coughing comes on in paroxysms, during which the face becomes swollen and livid, the eyes turgid and prominent, and there is more or less cerebral disturbance. There is often dysphagia, and the drinks are returned through the nose; in some cases, the epiglottis may be felt swollen, turgid, and erect, and on inspection is seen red and shining. The cough, which is at first dry, is afterwards attended with the expectoration of a thin and acrid secretion, which, *should the case* proceed favourably, becomes

bland, viscous, and transparent, and gradually changes to a yellow.

Should the disease progress to a fatal termination, all the symptoms become aggravated; the mucous membrane of the larynx becomes swollen, and the rima glottidis is so contracted as not to allow sufficient atmospheric air to pass to the lungs; hence there is great dyspnœa, with violent action of the respiratory muscles. As the rima becomes more contracted, the difficulty of breathing increases, the patient sits up in bed, tosses about his limbs, his eyes are prominent and tearful; and he dies apparently exhausted by his efforts; or, if a strong person, in a convulsive struggle. When the disease terminates more slowly, it is supposed that death is produced by blood, which is not duly aërated, circulating in the brain.

This disease may be mistaken for foreign bodies in the larynx, acute pneumonia, pleuritis, acute pericarditis, tumours pressing on the larynx, hysteric spasm, &c.

Treatment.—In the earliest stage of this disease bleeding should be employed, and repeated if it be requisite. Calomel, opium, and tartar emetic may also be given, but if the disease does not yield, *tracheotomy* is the only resource. Leeches and blisters to the throat are objectionable, as they would greatly interrupt the performance of the operation.

Sometimes the disease affecting the glottis is not so much acute inflammation, though very rapid, as *œdema*, the result of a low degree of vascularity. Tracheotomy and purgatives are the chief resource.

CHRONIC DISEASE OF THE LARYNX may consist of *chronic inflammation and thickening:* of *ulceration, common* and *syphilitic;* disease of the *cartilages,* and *morbid growths.* Ulceration is very common in consumptive patients.

In cases of chronic inflammation or ulceration,

attended with husky voice, and irritating cough, and tenderness, the regular application of a few leeches, the very gentle administration of mercury; sometimes *swabbing* the upper orifice of the larynx with solution of lunar caustic, may be of use. But if dyspnœa and choking cough increase, the safest plan is to open the larynx or trachea, whereby spasm of the glottis is prevented, and the part being at rest is more likely to get well.

CROUP.—*Symptoms.*—Three stages of this affection have been noticed by the best authors—1st, *the invading, or catarrhal;* 2nd, *the developed, or inflammatory;* 3rd, *the stage of albuminous exudation, with threatening suffocation.*

First stage.—In the *catarrhal* stage there are slight febrile symptoms, consisting chiefly of alternating chilliness and heat, and in more acute cases the skin becomes hot, the pulse accelerated and hard, and the countenance flushed; the child is either dull or in excited spirits; there is generally more or less pain in the head. In other cases, in addition to these symptoms, those of common catarrh are present; in some instances, the cough may be slightly resonant, but the respiration is not stridulous.

Second stage.—The duration of the catarrhal stage is very variable; it may continue but for two or three hours, or may last as many days, when the *inflammatory* stage sets in. The fever now increases rapidly; the respiration becomes difficult and sonorous; the cough may be either loud, dry, and clangous, as if passing through a brass tube; or it may resemble the barking of a young puppy. The inspiration is dry, hissing, and slow, and produces a sound similar to that which would be caused by forcing a piston down a dry pump. In most cases, the sympathetic fever runs very high; the skin is hot and burning; the pulse is frequent and hard; the face flushed, *sometimes covered with perspiration*; the bowels are con-

stipated; and the urine is scanty, highly coloured, and generally albuminous. The head is now commonly thrown backwards; and the child, either by its speech or attitudes, expresses a feeling of anxiety, with pain and constriction about the trachea and larynx, which are often tumefied externally. These symptoms, with the exception of the hoarseness of the voice, quickness of the pulse, peculiar cough, and sibilous inspiration, evince distinct remissions during the day.

Third stage.—The cough, which was at first dry, or attended with a scanty muco-sanguineous expectoration, now becomes husky and suffocative, and is frequently attended with abortive efforts to excrete what is felt in the trachea; the sense of suffocation is increased, and the fits of coughing are accompanied by the expectoration of a glairy mucus, containing shreds of the adventitious membrane. As the disease advances, there is total absence of any distinct remissions; the pulse becomes accelerated, small, weak, and irregular; and the cough is less frequent, less audible, but suffocative. If a fatal termination is approaching, the patient tosses about in great distress; seizes on objects around him, and grasps them convulsively for a moment; throws his head back; seizes his throat, as if to remove some obstacle to respiration; makes forcible efforts to expand the lungs; and after a variable duration of such sufferings, seldom above twenty hours, dies, either with signs of convulsive suffocation, or those of complete exhaustion of vital energy. Such is the course of the severe form of croup, when left to nature, or when unchecked by treatment.

In some *slight forms*, hoarseness, with a hard, ringing cough, succeeded by a crowing or stridulous inspiration, present chiefly in the night, and remitting during the day, are the only symptoms; the respiration and pulse being but little disordered in the intervals, and the febrile symptoms not very acute.

Physical signs of croup.—When the disease extends to the bronchi, the respiration about the sternum, which is naturally bronchial, becomes sibilant and whiffling; but it is sometimes difficult to distinguish from a similar rhoncus which generally, also, has its seat in the trachea. The clearest physical sign of inflammatory tracheal croup is, the detachment and expectoration of the albuminous concretions formed in the air-tubes.

Morbid appearances.—The mucous membrane lining the larynx, upper part of the trachea, and sometimes even the larger divisions of the bronchi, exhibits a greater or less degree of swelling and redness; it is sometimes covered by a *false membrane,* of a pale yellow or greyish colour, the thickness of which is greater in the larynx and trachea than in the bronchi.

Treatment.—The patient should be confined to his room, all stimulating diet forbad, and an antimonial emetic immediately prescribed. After the vomiting, the child should be kept in bed, the bowels ought to be freely acted upon, tepid diluents should be given, and small doses of ipecacuanha be persisted in. A hot poultice may also be applied to the throat.

When the inflammatory stage has become developed, the treatment must be bold and decisive, for the life of the patient depends on what is done within the first six or eight hours of this disease. If croup be not accompanied by a strongly-marked asthenic diathesis, or does not occur in very young infants, the treatment of this stage ought to commence with one or two bleedings from the arm, or from the jugular vein. In weak children, leeches to the throat may supersede the necessity for venesection. It is recommended not to apply leeches over the larynx, but rather along the line of the clavicles, as they often induce an œdematous state of the skin or ecchymoses, which occasion a stiffness *of the parts,* and add to the suffocating *feeling of the patient.*

Two methods of treatment are strongly advocated in this disease, the one being the *mercurial*, the other the *antimonial*. Calomel, with James's powder, is to be preferred, 3 grains of the former with 2 or 3 of the latter may be given every second or third hour. If the powders do not act upon the bowels, castor oil, or some other purgative, may be administered.

The treatment by tartarized antimony consists in one grain of the salt being dissolved in one ounce of distilled water; a desert spoonful is given every quarter or half hour, so as to keep up constant nausea.

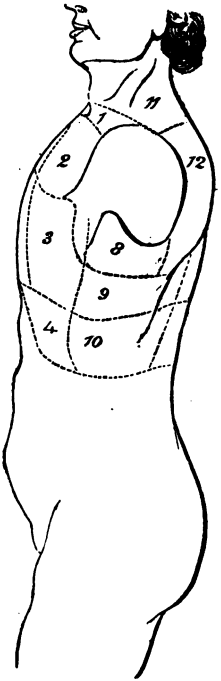
In the advanced stage, treatment is of little avail.

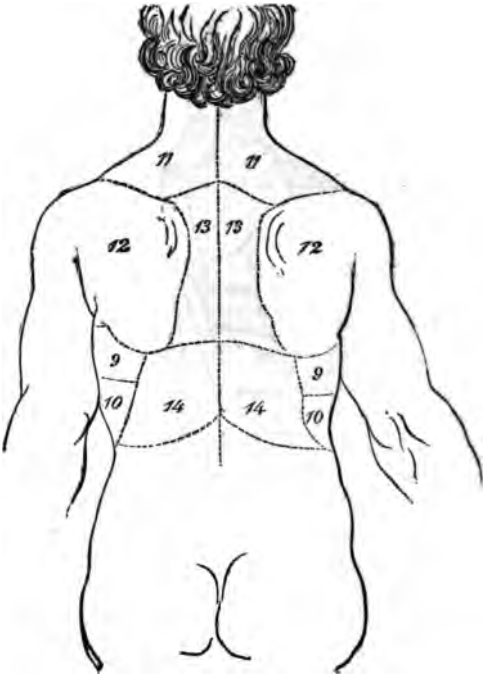
The operations of laryngotomy and tracheotomy have been performed in croup, where no other chance is left; the latter is the operation which has been attended with most success.

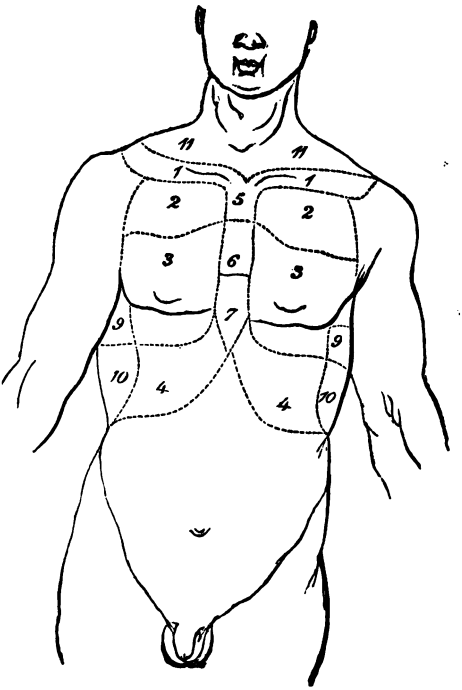
SPASM OF THE GLOTTIS, or *spasmodic croup*, as it is sometimes very improperly called, is very different from the preceding disease. It consists in a sudden choking fit, caused by a spasm of the muscles that close the glottis. There is no fever, nor any morbid appearances about the throat; the disorder is purely functional. It occurs to children, especially during the irritation of teething or weaning. The child suddenly loses its breath, tosses up its arms, turns bluish about the mouth, and when it recovers its breath, makes a long crowing inspiration. This complaint is often fatal.

During the fit, the best remedy is to sprinkle a little cold water on the child's face; in the intervals the bowels must be opened, the diet rendered light and digestible, and the child put into the best possible state of general health. Very small doses of prussic acid with an alkali are sometimes of service.

Before entering further into a description of the diseases of the respiratory apparatus, I shall place before the reader a tabular view of the thoracic regions, in relation to the signs of auscultation, &c.


1
11
2
12
3
8
9
4
10


11
11
12
13
13
12
9
9
10
14
14
10


11
11
1
1
2
5
2
3
6
3
7
9
9
10
4
4
10

Tabular View of the Thoracic Regions, in relation to the Signs of Auscultation, &c.

(See PLATES.)

Regions.	No.	Situation.	Natural Sound on Percussion.	Interior Corresponding Parts.	Signs most commonly produced there by Disease.
1. Clavicular (subclavian of Laennec).	2	Clavicles.	Very clear towards the sternum; clear in the middle; dull, close to the humerus.	Apices of the lungs.	Dulness on percussion in phthisis; generally most on one side.
2. Infra-clavicular (anterior superior of Laennec).	2	Between the clavicles and the fourth ribs.	Very clear	Superior lobes of the lungs; large bronchi near the sternum.	Irregular dulness on percussion, diffuse bronchophony, impaired respiration, and afterwards, cavernous rhonchus, and pectoriloquy, in phthisis. Various rhonchi in catarrhs.
3. Mammary.	2	Between the fourth and eighth ribs.	Very clear; particularly by mediate percussion. In women, a clear sound can be obtained through the mammæ only by mediate percussion.	Middle lobes of the lungs; large bronchi in the upper part, near the sternum; the heart, generally covered by the lungs, in the lower part of the left region.	Rhonchi in catarrh; more rarely phthisical symptoms. On the left side, dulness on percussion in hydropericardium and enlargement of the heart; increased impulse in hypertrophy, and increased sound of pulsation in dilatation of the heart; constant bellows or rasp sound in valvular disease.

		cartilages of the false ribs.	nant.	by the thin margin of the anterior inferior lobes of the lungs.	emphysema.
5. Superior sternal.	1	Upper part of the sternum.	Very clear	Large bronchi	Bronchial rhonchi in catarrh.
6. Middle sternal.	1	Middle part of the sternum.	Very clear	Margins of the middle lobes of the lungs.	Only half the sternum dull on percussion in hepatization, the whole dull in extensive liquid effusion, of one side.
7. Inferior sternal.	1	Lower part of the sternum and ensiform cartilage.	In the upper part clear; rather less so in fat persons. Below, sometimes more dull; sometimes tympanitic.	Above, margins of the lungs; below, the heart, liver, and sometimes the stomach.	Signs of diseases of the right side of the heart: dulness on percussion in effusion, or fat, in the pericardium, enlarged heart, &c.
8. Axillary.	2	In the axillæ above the fourth ribs.	Very clear	Upper part of the lateral lobes of the lungs. Large bronchi.	Dulness on percussion, cavernous rhonchus, pectoriloquy, &c., in phthisis. Catarrhal rhonchi.
9. Lateral.	2	Between the fourth and eighth ribs, at the sides.	Very clear; unnaturally so in emphysema of the lung.	Middle of the lateral lobes of the lungs.	Dulness on percussion in advanced pleurisy; and on the right side, from enlarged liver. Ægophony in advancing pleurisy; crepitant rhonchus, and bronchophony in advancing pneumonia.
10. Inferior lateral.	2	Below the eighth ribs, at the sides.	The same as the infra-mammary.	Margin of the lateral lobes of the lungs; the liver on the right side; the stomach and spleen on the left.	Crepitant rhonchus in incipient pneumonia. Extinction of respiration in pleurisy.

Tabular View of the Thoracic Regions, etc.—continued.

Regions.	No.	Situation.	Natural Sound on Percussion.	Interior Corresponding Parts.	Signs most commonly produced there by Disease.
11. Acromial.	2	Between the clavicles and upper margin of the scapulæ.	Dull by direct percussion. A tolerably clear sound may be elicited by mediate percussion, particularly near the clavicles.	Superior lobes of the lungs, and large bronchi.	Dulness on percussion in extensive tubercular accumulation; cavernous rhonchus and respiration, and pectoriloquy in phthisis. Catarrhal rhonchi.
12. Scapular.	2	The scapulæ and the muscular ridge below them.	The pectoral resonance can be elicited from this region only by mediate percussion.	Middle posterior lobes of the lungs.	Catarrhal signs. Ægophony in pleurisy. Bronchophony in pneumonia.
13. Interscapular.	2	Between the inner margin of the scapulæ.	Pretty clear by mediate percussion, or when the arms are crossed, and the head bowed forwards. The spinous processes of the vertebræ sound well.	The roots, and inner parts of the posterior lobes of the lungs.	Catarrhal signs. In the upper part, sound of respiration never destroyed in effusions into the pleura. In the lower portion, sometimes ægophony in pleurisy, crepitation and bronchophony in advancing pneumonia. Signs of diseased bronchial glands.
14. Inferior dorsal.	2	Below the inferior angles of the scapulæ and border of the serrati, to the level of the 12th vertebra.	Clear on the upper portion, by striking on the angles of the ribs, or by mediate percussion. Below, dull on the right, and tympanitic on the left side.	Base of the lungs. The liver encroaches on the right, and the stomach on the left side.	Crepitant rhonchus and bronchophony in incipient pneumonia and œdema; ægophony in pleurisy; and dulness on percussion in both.

BRONCHITIS is an inflammation with altered secretion of the mucous membrane of the bronchi. It may present itself under three forms—viz., the primary, secondary, and complicated. The *primary* form is that in which the first morbid influence seems to be exerted on the respiratory mucous membrane, and in which any fever present must be regarded as symptomatic. In the *secondary* variety, on the other hand, the disease depends on the pre-existence of some other malady; especially disease of the heart, fever, and the exanthemata. The *complicated* form accompanies other diseases of the lung,—such as pneumonia, pleuritis, pulmonary hæmorrhage, tubercle, &c.

According to the habit of body and vital energy of the patient, and the extent to which the inflammatory action advances along the bronchial tubes, *acute primary bronchitis* may be subdivided into three forms: 1st, common catarrhal bronchitis; 2nd, sthenic, or true bronchitis; and 3rd, asthenic bronchitis.

COMMON CATARRHAL BRONCHITIS.—This is the most common form of the disease, and is commonly known as *severe cold*. It seems to affect the whole surface of respiratory mucous membrane; from the nose, and frontal sinuses, downwards. It is evidently a constitutional disorder; and begins with shivering, headache, and feverishness, with pain and weight in the frontal sinuses (*gravedo*), and dryness, irritation of the Schneiderian membrane, sneezing, and snuffling (*coryza*). Then follow slight sore throat and hoarseness, and the irritation extends down into the chest. This is accompanied, or succeeded by titillation of the larynx, exciting a dry, hard cough; hoarseness, with a sense of tightness across the chest; and sometimes pain on coughing or on making a deep inspiration, and soreness and heat behind the sternum, and between the shoulders, which are the great signs of *bronchial irritation*. The constitutional symptoms are *great lassitude*, pains in the back and limbs, cold

chills, quick pulse, dry skin, and high-coloured urine. The cough, which was at first dry, is soon attended with the expectoration of a somewhat saline, glairy, thin fluid. If the disease be of a mild type, the expectoration, in two or three days, becomes thicker, more abundant, tenacious, and less irritating; and as amendment advances, the sputum increases in quantity, but is more opaque, tenacious, and deeper coloured, being frequently greenish-white. With these changes, the constriction, pain, and soreness are mitigated; the pulse becomes less frequent; the skin cooler and moist; and the urine less scanty, paler, and deposits a sediment.

STHENIC, OR TRUE BRONCHITIS may succeed the catarrhal, if neglected. It is ushered in by chills, or sometimes complete rigors; which are soon followed by quickened and laborious respiration; oppression at the chest; sometimes a dull pain on coughing; quick, full, and often strong pulse; pain in the forehead, back, and limbs; foul, loaded tongue; constipated bowels, and high-coloured urine. As the disease progresses, the frequency of the pulse, the cough, expectoration, and general febrile symptoms increase, as well as the tightness and soreness of the chest. Sometimes there is a very sharp, though transient, pain extending over the whole chest, particularly after fits of coughing. When the cough is violent, the patient feels also pain and weakness about the attachments of the diaphragm, along the borders of the false ribs, and in the back. The febrile and other symptoms are aggravated towards night, which is generally sleepless and disturbed. In extreme cases of this affection, collapse, with diminished expectoration, purple lips, orthopnœa, quick, depressed pulse, cold perspirations and extremities, with threatening suffocation, occur early.

ASTHENIC BRONCHITIS (Peripneumonia notha, or *Suffocating Catarrh*,) is an extensive inflammation of

he bronchial mucous membrane, in a weak constitution, with very great secretion of mucus. This copious ecretion is the great source of danger.

"There are four cases," says M. Laennec, "in vhich catarrh may become suffocative—1, in old persons; 2, in persons affected with œdema of the lungs; , in the dying; 4, the acute catarrh may sometimes ssume this character even in adults and children.

Bronchitis in old persons is frequently mortal, ccurs principally in winter, and in consequence of he supervention of an acute catarrh on a chronic nucous catarrh, or phlegmorrhagy. It is liable to ccur to old people with diseased heart, and with hronic catarrh, if they catch cold. If of any coninuance, œdema of the lungs supervenes and hastens he fatal termination.

Of the Sputum in Bronchitis.—In the first stage of bronchitis, the cough is dry. At the end of a time, ach fit of coughing is followed by the excretion of a lear, transparent, serous or watery mucosity, which s at first slightly saline, but afterwards becomes tasteess. As the disease advances, the matter expectorated is a glairy mucus, like white of egg; when it is oured from one vessel into another, it is observed to low in one mass of extreme tenacity. When the paient is attacked with violent fits of coughing, accomanied by considerable heat within the chest, as also y marked distress and general anxiety, the expectorated matter acquires remarkable viscidity, and resembles a little the jelly-like sputa of acute pneumonia. The viscidity of the mucus varies with the inflammaion, and in some cases is streaked with blood. In hronic cases, the mucus assumes a yellowish colour, nd resembles purulent matter. In the declining tages, the secretion is occasionally of a slate or even lackish colour.

Physical Signs of Bronchitis.—English physi*ians now recognise* two great divisions of morbid

respiratory sounds; the *dry* and the *moist*. The dry are caused by the obstruction of the bronchial tubes, by a swelling of their lining membrane, or by plugs of tough mucus. The moist are caused by the presence of liquid—whether mucus or blood, through which the air passes in bubbles in its entrance into and exit from the lung. The dry sounds are called *rhonchus*, when grave or deep, because situated in the larger tubes; and *sibilus*, when of an acute whistling character, because situated in the smaller tubes. The moist sounds are called *crepitus*; which may be *large* or *small*, according to the size of the tube in which it occurs.

The first physical signs of bronchitis (and these sometimes are present before the cough comes on, and while the local feelings only indicate a coryza, or a raucity and dryness in the throat) are of the *dry* kind; sometimes a small *whistling* or *hissing*; sometimes like the prolonged note of a violoncello, and sometimes the cooing of a dove. When the membrane begins to secrete, the sounds above mentioned gradually disappear, and are replaced by *moist* or *crackling* ones produced by the successive formation and rupture of bubbles in the air-tubes. It sometimes happens that, during the course of a bronchitis, we suddenly cease to hear, in a certain extent of the lung, either the natural sound of the pulmonary expansion, or the crepitation In this same part, where the ear no longer hears any murmur, the chest when percussed retains its usual sonorousness. The explanation is, that the tube leading to a considerable portion of lung has been temporarily blocked up by mucus; but it may often be cleared by a vigorous cough. This at once distinguishes bronchitis from almost all other affections of the lungs. Thus, though percussion gives no direct result in this disease, its employment is of importance in the particular diagnosis. For example, if a person has had a severe cough, fever, hurried and differ-

breathing for some days, and the chest still sounds well, the great probability is, that the disease is bronchitis.

Morbid Appearances. — After a mild and recent bronchitis, there is found some redness in a circumscribed portion of the mucous membrane; particularly towards the termination of the trachea and commencement of the bronchi. If the inflammation has been more intense, the redness extends to a greater number of tubes; and to some of the smaller ramifications. It frequently occurs that this redness is exactly limited to the bronchi of only one lobe; it is the bronchi of the upper lobe which appear more particularly disposed to become inflamed. The red colouring of the bronchi sometimes presents itself in the form of a fine injection, which seems to exist simultaneously both in the submucous cellular tissue and in the mucous membrane itself; sometimes vessels are no longer distinguished, but only a number of small red points, crowded together, and collected round each other; sometimes there is observed a uniform red colour. Frequently the redness exists only at intervals, in the form of bands or separated patches, which constitute, as it were, so many circumscribed inflammations, between which the mucous membrane is white and healthy—a form of inflammation similar to that so frequently observed in the intestines. When the inflammation is chronic, the mucous membrane generally loses its bright redness; it presents a livid, purple, brownish tint. It is very remarkable, that in persons presenting all the symptoms of an inveterate chronic bronchitis, with puriform expectoration, the mucous membrane of the air tubes is scarcely of a rose colour, or is sometimes even perfectly white through its whole extent. According to Bayle, *this white state of the mucous membrane is not rare in pulmonary catarrh.* The other changes remarked in chronic bronchitis are, *thickening, softening, but* rarely ulceration, of the mucous

membrane; in chronic cases, dilatation of the bronchi. In only two instances has M. Andral detected ulcerations in the bronchi.

Dry Catarrh.—This name is given by the French to a not uncommon variety of bronchitis; in which there is great dyspnœa, and intense congestion of the membrane, with sibilus or dry sounds, but the ordinary secretive stage is very slow to come on.

Treatment.—In *simple catarrhal bronchitis*, confinement to bed; inhalation of steam; an aperient; a warm bath; a few grains of Dover's powder with a little antimony at bed time; some demulcent for the cough; and low diet, are usually sufficient.

When acute bronchitis occurs in a robust habit, a moderate bleeding is decidedly indicated; but, as in other mucous inflammations, we must regard general depletion more as a means for reducing the febrile excitement, and preparing the patient for local treatment, than for cutting short the disease. The bowels next should be attended to, and freely acted upon by mild aperients. After general bleeding and purgatives, local depletion will be found extremely beneficial; and Dr. Stokes recommends "that in severe cases the patient should be cupped under the clavicles, or between the scapulæ, or a number of leeches be applied under the clavicles, or into the axillæ." After moderate depletion, it will be right to use some antiphlogistic remedy;—and as mercury is not so beneficial in inflammations of mucous as of serous membranes, *tartar-emetic* is to be preferred. It should be given in small doses at regular intervals—say gr. ¼ 4tis horis in solution with a drachm of syr. papaveris and some distilled water, and be continued till it causes nausea, and lowers the heart's action. In some cases, after the system is brought under its influence, the disease yields suddenly; the oppression and wheezing cease, the cough becomes trifling, the lividity disappears, the pulse falls, and the respiration, with the

ception of a slight crepitation, which is occasionally ard, is healthy, pure, and equal. In others, a copious cretion is produced, with great relief.

Some practitioners prefer ipecacuanha as less likely purge and weaken. Emetics are extremely useful bronchitis, particularly in the *asthenic form*, and in e sthenic variety after bleeding; in children, their hibition is attended with the best results. For ildren, ipecacuanha should be preferred; for aged rsons, the sulphate of zinc; and, for the robust lult, tartarized antimony.

When the inflammatory action and febrile heat have en subdued, blisters are of much service, and may applied either between the shoulders or on the east. A large warm poultice to the chest is also eful, especially for children.

Stimulating expectorants and tonics are now given ith decided benefit. Amongst the first class, I may umerate senega, the balsams, ammoniacum, squill, d myrrh; and in the second, improved regimen, ine, bark, serpentary, the preparations of iron, &c. bad cases of bronchitis, in addition to the internal eatment, counter-irritants should be persisted in for me time. The counter-irritants most employed are, isters, tartarized antimony ointment, croton oil, the etum cantharidis, and pitch plasters containing cnthariles or tartarized antimony. Dr. Stokes re-mmends a stimulating liniment, which, when applied the chest daily, keeps up an erythematous state of e skin.* He considers that this liniment not alone ts beneficially by its counter-irritating properties, t that the ingredients are absorbed by the surface, as to act on the mucous membrane as direct stimu-nts.

In *asthenic bronchitis*, with copious suffocative secre-on, our greatest dependence is to be placed on emetics

* The *following is his formula*:—℞ Sp. terebinth. ʒiij.; Acid. *nt.* ʒss.; *Vitell. ovi, j.*; Aq. rosar. ʒiiss.; Ol. limon. ℥j. M.

for children; and for old people, on warm purgatives, blisters, and stimulating expectorants, especially senega and ammonia. Diuretics are afterwards of service.

Opiates always require caution in bronchitis which is attended with profuse secretion. It is true, they ease the cough; but then it must be recollected that the cough is the only means of getting rid of that superabundant mucus which is choking the patient, and that if the cough stops, the patient will perish; *drowned*, to all intents and purposes. Particular caution must be used if there is any appearance of venous blood circulating—livid lips, or coma. Yet, as it is right to allay inordinate irritation, small doses of paregoric may be combined with the stimulant expectorants, to moderate the violence of the cough; and a larger dose may be given at bed-time, if the patient is worn out from want of sleep, and can expectorate freely.

PERTUSSIS (*Whooping Cough*).—This affection is contagious; it seldom occurs twice in the same individual, and particularly attacks children; but adults are liable to it, if they have escaped it in their childhood.

Symptoms.—It commences with symptoms of common *cold*, or *catarrh*, which may last for some days; the cough then becomes convulsive, and recurs in fits at various intervals. The fits may last a quarter of an hour or more. Each fit is composed of a quick succession of sonorous coughs, with scarcely any perceptible inspiration between; but at intervals the expirations of coughing are suddenly interrupted by a very deep, sonorous inspiration, or *whoop*, which constitutes the pathognomonic sign of this disease. The peculiar whooping inspiration depends on spasm of the glottis. The face becomes swollen and livid in the paroxysm, and particularly during the whooping. The fit terminates by the expectoration of a colourless and scarcely frothy phlegm, and in many cases by vomiting also. The paroxysms at first recur several times every day,

ways more severe towards evening, but less so
:he night. After a certain time, they only
n the morning and evening; and towards the
ıe disease, in the evening only. The duration
ping cough varies from a few weeks to several

Before it terminates, the paroxysms become
lose their peculiar characters, and are attended
xpectoration more decidedly mucous. This
may be complicated with bronchitis, or pneu-
which are the chief sources of danger:—or it
ıse cerebral symptoms, or sometimes a real
y. The younger the child, the greater the

In some cases, the disease degenerates into a
mucous catarrh, with emaciation, and other
ns resembling phthisis. In the intervals of the
ms, the patient coughs but little, preserves his
and strength, and has rarely any fever except
ıse above mentioned, or in the onset of a very
ttack.

ıe first invasion, this disease may be mistaken
p, or suffocative catarrh.

id Appearances.—These depend on the extent
ınmation in the lungs, and vary accordingly.
ractitioners consider the disease to depend on
ıble state of the spinal marrow, and especially
eat of the origin of the eighth pair of nerves,
t it accordingly.

ment.—In the early stages the indications are,
inflammation, to promote expectoration, and
ıe irritation. The child should be confined to
se if the weather is inclement; it should have
t; the bowels should be kept open; an emetic
ipec. should be given about every other night,
ınever the chest appears much loaded with
; a grain of calomel and a warm bath at bed-
ıy be given if there is much feverishness: and
inflammatory symptoms arise, they must be
d by leeches. A mixture of vin. ipec. sodæ

sesquicarb. with small doses of Battley's liquor opii (according to the child's age) may be used with benefit.

Frictions to the spine are beneficial throughout; olive oil, and oil of amber; soap liniment and laudanum are useful materials.

When the acuteness of the complaint is over, tonics, especially quina, and sulphate of zinc; the inhalation of strong smelling salts when the fit is coming on; and especially change of air, are the best means of getting rid of the dregs of the disorder.

CHRONIC BRONCHITIS. — The chief *symptoms* of chronic bronchitis are, cough, shortness of breath, and expectoration of various kinds of mucus.

Causes.—This complaint is very common, especially in old people. It may, like other chronic inflammations, be a consequence of one or more acute attacks; or it may, especially in old people, depend on that congestion which is infallibly produced in the lungs by disease of the heart. When habitual and attended with expectoration, it is called *humoral asthma.*

The sounds heard by *auscultation* in simple cases, consist of the crepitation and bubbling of mucus in the air-tubes, of various sizes.

Sometimes this malady presents all the outward marks of *phthisis;* wearing cough; profuse purulent expectoration; wasting, night-sweats, &c. But yet so long as no important organic change has occurred, it is quite curable. The *diagnosis* must be guided by the circumstance, that in chronic bronchitis there is no solidification of the upper lobes of either lung; no pectoriloquy, or signs indicating a cavity or *vomica.*

Treatment.—Occasional leechings or cuppings to obviate congestion; blisters and other counter-irritants; mild, nutritious, unstimulating diet; change of air; tonics, such as sulphate of zinc, with small doses of pil. scillæ comp., and opiates to allay the cough, are amongst the chief remedies for younger patients. The

mixt. ferri c., from its containing myrrh, and the mixt. cascarillæ c., are useful forms.

For older habitual cases, and especially if the expectoration is profuse, the stimulating expectorants, especially tinct. benzoes c., bals. copaibæ, senega, &c., are indicated; inhalation of tar vapour also is useful.

BRONCHIAL POLYPI. — Dr. Watson gives some interesting cases of bronchial inflammation, attended with the expectoration of false membrane, moulded to the shape of the bronchial tubes. These cases were also attended with hæmorrhage, and with expectoration of cylindrical fibrinous clots, that had collected in the bronchi.

INFLUENZA.—This is a contagious febrile disorder, attended with great languor and depression of the vital powers, and extreme irritation of the bronchial membrane or some other part of the respiratory apparatus. The symptoms vary more or less in every epidemic: and the great rule of treatment is, to *soothe* pain at the least expense of strength, and lower as little as possible.

SPASMODIC ASTHMA is caused by a spasm of the muscular fibres encircling the bronchial tubes, and especially the smaller ones, the existence of which was proved by Reississen, and has been confirmed by Dr. Williams and others, who have produced contraction of them by galvanism.

The *exciting* causes of the purely spasmodic variety of asthma are those which impress the nervous system—as strong or peculiar odours, mental emotions, and particular states of the atmosphere, and particularly irritation of the stomach and bowels.

Symptoms.—The attack of spasmodic asthma takes place generally about one or two in the morning, and during the first sleep. The patient suddenly awakes, with a sense of suffocation, great tightness at his chest, difficulty of breathing, and excessive anxiety; he assumes with great eagerness the erect posture, and

cannot bear the least incumbrance about the chest. The respiration is wheezing, interrupted, and laborious; the shoulders are raised, the elbows directed backwards, and every effort made to enlarge the thorax. The countenance, which was at first pale and anxious, becomes, especially in plethoric habits, suffused or bloated, and covered with perspiration. A considerable quantity of pale urine is voided at the commencement, or previous to the accession, of the paroxysm; and the lower extremities are usually cold. The pulse is generally quick, weak, and somewhat regular. During the fit, the patient has commonly an instinctive desire for cool air. When the fit has continued from half an hour to one, two, three, or even four hours, some degree of cough and expectoration comes on, which relieves the patient; and after a brief period, his respiration, pulse, and feelings assume their natural state. Occasionally the patient has but one such fit, but more generally a slight constriction of the chest is felt through all the succeeding day, and the paroxysms return at the usual period of the night; this may occur for several nights, and at last the patient is relieved altogether from the attack. The disease may be suspended for several months, but it is liable to recur from changes of air, errors of diet, and the operation of other causes.

Physical Signs.—In spasmodic asthma, during the fit, the chest does not sound well on percussion, and the respiratory murmur is indistinct, even on the most forcible inspiration. But if the patient, after holding his breath a short time, be desired to breathe again quietly, the spasm will be for a moment overcome, and the entry of air into the cells will be heard in a clear and somewhat puerile sound; after one or two inspirations, the spasm again comes on, and the respiration becomes as dull as before.

The muscular fibres being in a state of spasm during the paroxysm, the obstruction to the entrance of the

air into the small bronchi and vesicles thus produced is obviously the cause of the diminution of the respiratory murmur. By this contraction also the lungs are in a manner collapsed within the chest, and the parietes of the thoracic cavity, pressed by the atmospheric weight on them, lose the sonorous elasticity produced by a fulness of their aërial contents.

Complicated Asthma.—Spasmodic asthma is generally combined with some disease of the heart, or some chronic bronchitis acting as a source of permanent congestion, which both adds to the difficulty of breathing, and predisposes the parts to be more easily affected with fits of spasm.

Sometimes a severe attack of *dry catarrh* (vide p. 492) is aggravated by spasm. This constitutes the *bronchial asthma* of Andral.

Morbid Appearances. — The most common consequences of the disease are, chronic inflammation and dilatation of the bronchi; the different varieties of emphysema and œdema of the lungs; hæmoptysis; tubercular deposits, with which asthma may be associated from its commencement; hypertrophy and dilatation of the cavities of the heart; atrophy of the heart; effusions into the pericardium; effusions into the pleura; and, in some severe cases, congestions or effusions within the head, giving rise to coma, or apoplexy.

Treatment.—This consists in administering narcotics and antispasmodics. These should be given, if possible, as soon as the *first sensations* are felt, and then they may avert the attack; and it is noticed, that those do most good which produce expectoration. Strong coffee; laudanum and æther; and stramonium smoked as tobacco, are the most trustworthy. Ipecacuanha, first given in an emetic dose, and afterwards in small quantities, so as to keep up a constant nausea, sometimes has a powerful effect on spasmodic asthma. *The tincture of lobelia inflata* (Indian tobacco) is much

used in America in asthmatic cases; it has also been employed in this country. It is nearly allied in its operation to stramonium and tobacco, and often succeeds in checking the paroxysm when given shortly before its invasion. Blood-letting is only required if there be inflammatory complication. Change of air, and even to a less pure atmosphere, is often beneficial.

DISEASES AFFECTING THE TISSUE OF THE LUNGS.

PNEUMONIA consists in an inflammation of the parenchyma of the lungs, and, according to the changes produced in the tissue, it is most commonly divided into three stages.

With respect to the *exact seat* of this disorder, Dr. Williams contends that it is in the capillaries of the pulmonary artery. But Dr. Watson and Dr. Stokes consider it to be an inflammation of the entire texture of the lung, including the minute tubes and air vesicles, and the cellular tissue which connects them.

Three stages.—The *first* stage of pneumonia is the stage of engorgement, in which the organ is found intensely loaded with blood; the *second* is the stage of *hepatization;* in which it is solidified by an effusion of lymph: the *third*, is the stage of *purulent softening*, or suppuration.

Pneumonia may be single or double; in other words, it may attack but one lung or both at the same time. In one and the same lung it may be general or partial, attack the upper or lower lobe, be confined to the base, the root, or the centre (*lobular pneumonia*). It has been said, that all these different seats of pneumonia have been equally frequent. Some numerical results will settle the question. Out of 151 pneumonias observed at La Charité, 90 affected the right lung, 38 the left lung, 17 existed simultaneously on both sides; the seat of the other 6 was not known. Of 90

pnuemonias recorded in the works of Morgagni, Stoll, De Haen, Pinel (*Médecine Clinique*), and Broussais (*Traité des Phlegmasies Chroniques*), 31 were observed on the right, 20 on the left, and 8 on both sides at once.

Thus, on the entire, out of 210 pneumonias, there were—on the *right* side, 121 ; *left* side, 58 ; both sides (*double*) 25 ; cases where the seat could not be detected, 6.

It has been asserted that the upper pulmonary lobes are scarcely ever attacked with inflammation. This statement is not correct ; those lobes are often affected, but not so frequently as the lower lobes. Morgagni, Frank, and Broussais, who draw their conclusions from dissections, state that the upper lobes are most frequently the seat of inflammation ; Laennec and Andral, on the other hand, who included cases of recovery in their calculation, found the lower lobes to be most commonly inflamed. This discrepancy may be reconciled, as Dr. Williams observes, by assigning as the cause of it the fact, *that inflammation of the upper lobes is the most frequently fatal.*

The disease, as it generally occurs, presents the following characteristic symptoms :—pain, more or less marked, in one of the sides of the chest ; dyspnœa, viscid and bloody sputa, dull sound, and modification of the respiratory murmur. The patient lies on the back ; the pulse accelerated, but variable in its character ; the fever is generally of the inflammatory kind, but is occasionally typhoid.

Of the pain.—According to Andral, this symptom only exists when there is pleuritis at the same time with the pneumonia. Laennec asserts, on the contrary, that there is frequently very acute pain, when there is no pleuritic inflammation at all. The pain is generally on the level of, or a little below, either breast ; *more rarely* it is seated either below the *clavicles or entirely* at the lower part of the ribs,

and even in the hypochondria, or, in fine, over all the extent of thoracic parietes of one side. In some cases it precedes by several days the appearance of the other symptoms; being then neither accompanied by fever, cough, nor dyspnœa, it simulates a pleurodynia, or simple rheumatic pain. The pain is increased by coughing, by the movements of inspiration, sudden changes of position, and intercostal pressure and percussion; it is principally exasperated by lying on the side on which it exists. M. Andral says, "In all patients who presented this pain to us, we found the pleura inflamed, and covered with membraniform albuminous exudations."

Of the dyspnœa.—The dyspnœa, in pneumonia, is generally in the direct ratio of the extent of the inflammation, of its seat, and of its intensity in each of the points which it occupies.

Of the sputum.—At the commencement of pneumonia there is frequently no expectoration, or it is simply catarrhal, being composed of mucus of moderate tenacity; but as the small crepitation becomes marked, the sputa assume their characteristic form. When the small crepitation becomes evident, which occurs about the second or third day, the sputa become *bloody*, that is, they consist of a tenacious matter intimately united with blood; not merely simple striæ of blood, as in bronchitis; neither is it pure blood, as in hæmoptysis. According to the quantity of blood which they contain, the sputa are either yellow, of an iron-red colour, or of a marked red. They are at the same time tenacious and viscid; they adhere together so as to form a homogeneous whole; but however little we incline the vessel containing them, they are still observed to flow from it with considerable ease. Thus, at this period of the disease, the sputa adhere firmly to each other, but they are not yet sufficiently viscid to adhere to the sides of the vessel. Frequently the sputa retain the

above characters all through the disease; in this case, the inflammation of the lung does not ordinarily pass the first stage, but oftentimes the sputa acquire still greater viscidity; they are no longer detached from the vessel when it is turned upside down.

We should under these circumstances have cause to apprehend that the second stage is advancing; in fact, as the viscidity of the sputa increases, the chest, when percussed, yields a duller sound, and the murmur of pulmonary expansion is either gone altogether, or is changed into bronchial respiration. In fine, the degree of viscidity announces with tolerable precision the intensity of the inflammation; and whenever, after having become thinner in the course of cure, the sputa regain their former viscidity, a relapse is indicated.

In the suppurative stage of pneumonia the sputum is generally characteristic. It then occurs under two forms; in the one, we observe a purplish-red mucopuriform fluid; while in the other, the matter expectorated has all the characters of true pus. In some cases, pneumonia runs through its different stages without its existence being announced in any way by the expectoration, which has been all through either absent or devoid of character.

When pneumonia terminates in gangrene, it is announced by the expectoration of a liquid at first greenish, then of a dirty grey colour, reddish at intervals, and exhaling a fœtid colour, like that of the gangrene of external parts.

At the commencement of this disease, the *face* is usually red; sometimes more so on the affected side than on the other. If the dyspnœa be considerable, the face presents a livid tint; and, when the lung is infiltrated with pus, a characteristic paleness is usually diffused over the entire face.

Delirium is frequently present during pneumonia, and generally manifests itself during the night; in most *cases, where it* appears only at intervals, it is an un-

important symptom. But when constant it is serious, as it shows there is a circulation of unoxidized blood.

Constant *decubitus* on the affected side has been given as a characteristic sign of pneumonia; but scarcely one patient in twenty lies in this way—they constantly lie on their back. It is chiefly in pleuritic effusions that the decubitus on the affected side is observed.

The pulse in this affection is most frequently quick and full; but when the inflammation is very intense, it is sometimes remarkably small, and this smallness disappears after a copious bleeding. In some cases, particularly those occurring in old persons, the pulse retains its hardness and strength; in such cases we may suspect that a hypertrophy of the left ventricle of the heart exists.

Physical signs: First stage.—According to Dr. Stokes, an *intense puerility of respiration in the affected part* will be found to exist for some hours before the characteristic crepitus is heard. But as soon as the first stage is fully developed, we know that where the pain is manifested, the natural respiratory murmur has lost its clearness; it is mixed to a greater or less extent with *the small crepitation;* a sound caused by the breaking of minute bubbles in the air cells, and resembling that caused by rubbing a lock of hair between the finger and thumb close to the ear. This sound indicates engorgement of the lung; whilst it exists, it is a proof that, in several points at least, the inflammation has not passed the first stage. As long as the natural respiratory murmur predominates over the crepitation, we should infer that the inflammation is slight; on the other hand, when the crepitation prevails so as altogether to mask the respiratory murmur, it is a certain indication that the pneumonia has made progress, and that it has a tendency to pass to the second stage. These phenomena soon change, either by the resolution of the disease, or by its making

ırther progress. In the former case, the crepitation iminishes in extent and intensity; the murmur of espiration approaches its natural state; the sound of he chest becomes less dull, and its movements more egular; and, finally, a large crepitation is evident, hich indicates an approach to convalescence.

In the first part of this stage, the sound on percus-on is only slightly impaired; but as the engorgement dvances, and the proportion of air in the inflamed pot of lung is diminished, it becomes more dull over ıe corresponding part of the chest.

Second stage.—The second stage of pneumonia is hat in which the lung presents that change which is alled by Lænnec *hepatization*. In this condition, the ells being obliterated, while the large tubes remain ervious, dulness on percussion, bronchial respiration, nd a loud resonance of the voice (*bronchophony*), are roduced; the extension or intensity of these signs ırnishes, within certain limits, an accurate measure f the extent or intensity of the disease. The *bronchial espiration* specifically marks the second stage of pneu-ıonic inflammation. It resembles the sound pro-uced by blowing through a crow's quill, and is fre-uently so loud as to amount to a whistle. If the in-ammation is extensive, the respiration is puerile in ther parts of the lung. The voice is much modified ı its resonance, and this modification is not properly ıat of ægophony, nor pectoriloquy; it approaches ıore to *bronchophony*.

If the patient recovers from the second stage, and ıe infiltration diminishes, so that the air is again dmitted to the minute tubes and vesicles, this is an-ounced by a return of the *small crepitation*, which is f course favourable.

Third stage.—In the third stage, the diseased lung ecomes infiltrated with a purulent matter, which is enerally *consistent* at first, but soon acquires the *uidity of common* pus. In this stage, a peculiar

muco-crepitating rhonchus is heard, at first in some points, then in the whole of the affected part.

Of abscess.—In the infancy of pathological anatomy, the formation of an abscess in the lung, as the result of acute or chronic inflammation, was considered a very common thing. The common error has been to mistake tubercular vomicæ, or interlobular pleuritic effusions, for abscess of the lung. When abscess, however, does form in an hepatized lung, the passage of air through the liquid will be indicated by the gurgling or cavernous rhonchus; and when the cavity has been emptied of the pus by expectoration, pectoriloquy and the cavernous respiration will be added to this sign.

Morbid appearances.—In the *first stage* of pneumonia, the substance of the lung presents an increase of weight and density; it is infiltrated with a frothy, sanguineous serosity, in considerable quantity; it pits on pressure, but yet is still somewhat crepitant; its integral cohesion is diminished, for it can be easily broken down between the fingers; the mucous membrane of the small bronchi is of a deep red colour.

In the *second stage*, or that of hepatization, the lung no longer crepitates; it now sinks in water; and when cut into, a red liquid, not frothy, nor so abundant as in the preceding stage, flows from it. Externally, the lung is of a deep red colour, and internally it is studded with a number of red granulations, with patches of a white colour, marking the vessels, interlobular septa, &c., less affected with the inflammation.

In the *third stage*, the pulmonary tissue, dense, compact, and impervious to the air, as in the preceding stages, presents a characteristic greyish colour. When examined with a lens, it presents granulations of a white or grey colour; these can also be seen by the naked eye in many instances. In a more advanced degree, the colour is of a straw, or sulphur yellow,

owing to the greater quantity of liquid pus; the texture is considerably destroyed; and if the lung be cut, and its tissue slightly compressed, without crumbling it, small drops of pus appear on the surface; these seem to issue either from the orifice of the capillary bronchi, or from the granulations themselves. This condition of the lung may be defined as "*grey softening.*"

Treatment.—When the practitioner is called in early in this disease, he should have recourse to copious bleedings; if not contra-indicated, to be followed by the exhibition of the tartarized antimony or mercury—the former is best adapted to the first degree of the inflammation, that of *engorgement;* and the mercurial plan to the second—to that of hepatization.

The tartar emetic may be given in doses of gr. ½ dissolved in water, with a few drops of syrup of poppies or laudanum, every hour: after two or three doses the dose may be doubled; and after two or three more it may be increased again, to a grain every hour. If the medicine acts favourably, it will relieve the dyspnœa, without causing more than very slight vomiting or purging. In those cases where tartarized antimony is inadmissible, or inefficient, the *mercurial treatment* must be had recourse to; calomel and opium ought to be given internally, and mercurial inunction be employed. *Aperients* should be occasionally given in this disease, so as to keep the bowels open; but too much purging is always injurious. When the patient is under the influence of antimony, enemata should be employed. *Local depletion* is also highly important in this disease. When the *acute stage has passed,* blisters may be applied to the chest.

The regimen should be strictly antiphlogistic; and with a view to prevent vomiting, very little liquid should be allowed during the antimonial treatment. During *convalescence* from this and all other acute *diseases of the chest,* visitors should be excluded, as

talking, even in an under tone, is injurious to the patient. An absence of chloride of sodium from the urine has been noticed in this disease. Dr. Beale supposes the salt to be transferred to the diseased lungs, a theory which may be well questioned.

EMPHYSEMA OF THE LUNGS consists in a *dilatation of the air cells*, the parietes of which may also be ruptured, in which case several may coalesce, and form a cavity of some extent; it is more frequently the consequence of other diseases than a primary affection.

Symptoms.—Habitual dyspnœa, which, during the earlier periods of the disease, is mitigated in summer, but returns in the winter with increased violence: the complexion is of a dusky hue; the countenance has an anxious and melancholy expression; the nostrils are dilated and thickened; the lower lip is enlarged, and its mucous membrane everted and livid. The movements of the thorax are irregular and habitually unequal; inspiration is short, high, and rapid; but expiration is slow, incomplete, and, as it were, graduated; there is thus a manifest difference in the duration of the two movements. The shoulders are elevated and brought forward, and the patient stoops habitually, a habit contracted in his various fits of orthopnœa and cough; thus, even in bed, we find these patients sitting up, with their arms folded and resting on their knees, and the head bent forwards, the object of which seems to be to relax the abdominal muscles, and to substitute the mechanical support of the arms for that of muscles which would interfere with inspiration. During the fits, the respiration becomes convulsive. There is a constant cough, returning in fits, usually dry, but often attended with the expectoration of a viscid liquid, of a dirty grey colour. This is one of the diseases long confounded under the name of "*asthma*."

Physical signs.—The chest yields a morbidly clear sound on percussion; it is not, however, tympanitic,

as in pneumo-thorax, but may be described as the maximum of true pulmonary sound.

Morbid appearances.—The ordinary appearance of an emphysematous lung is a remarkable coarseness of the vesicular texture, as seen through the pleura, it is also elastic, lighter, and less crepitant than usual, and does nor collapse. In a greater degree, the enlarged cells look like the vesicular lungs of cold-blooded animals, and occasionally raise the surface of the lung into rounded inequalities. Single vesicles, like fish bladders, of various sizes, sometimes project from the surface or margins of the lung, in some instances attaining an extraordinary bulk.*

Treatment.—The patient should clothe warmly, particularly about the feet, and should live in a sheltered genial situation. He should also take care to avoid all causes of indigestion and flatulency, because if the action of the diaphragm is impeded, an attack of dyspnœa may be brought on directly.

The fits of dyspnœa may often be relieved by opium and æther.

INTERLOBULAR EMPHYSEMA.—This name is applied to an escape of air from the pulmonary vesicles, and its infiltration into the common cellular tissue of the lung. It is a rare affection, and is produced by violent straining efforts, made whilst the glottis is closed; such as the efforts of parturient women, &c. It is said to be evidenced by dyspnœa, and friction sound, caused by the rubbing of the distended pleura pulmonalis against the pleura costalis. Venesection would relieve the dyspnœa.

ŒDEMA OF THE LUNGS.—*Œdema of the lungs* is, properly speaking, a serous effusion into the interstitial tissue between the air cells and vascular rete, by which these are connected together. This effusion, by swelling up the interstitial texture, so presses on, and

* *Dr. Hope's* Morbid Anatomy, Part 2.

partially obstructs, the smaller bronchi, that the respiration is rendered laborious and difficult. It is by no means an uncommon disease.

Symptoms.—Dyspnœa, the intensity of which is generally in the ratio of the effusion; slight cough, followed by the expectoration of an aqueous fluid, more or less in quantity. Sometimes there is no excretion whatever; but if the œdema be combined, as it often is, with catarrh, the expectoration increases considerably, and also changes in its appearance. It then consists of a colourless pituitous fluid, very similar to the white of an egg, mixed with an equal quantity of water; it contains, also, bubbles of air. In cases where the œdema is complicated with partial spots of pulmonic inflammation, amid the mass of expectoration just described, there are found some sputa of a tawny greenish or light rusty colour, but still transparent. General serous infiltration of the body is frequently coincident with œdema of the lungs.

Physical signs.—Slight dulness on percussion at the lower part of the lung; some degree of vesicular breathing, with large crepitation. Where the œdema is very extensive, the resonance of the chest is much diminished; the respiratory murmur is also very feeble.

Morbid appearances.—The tissue of the lung, of a pale greyish colour, is more dense and heavy than natural; it is crepitant, and collapses only when by compression it is freed from the liquid that is infiltrated into it; the lung seems to contain very little blood, but is gorged with a colourless, transparent, frothy serosity; the air cells retain their natural texture.

Treatment.—The treatment of this affection must depend on the cause producing it: thus, if it arise from disease of the heart, our treatment must be directed to that organ; if it occurs at the termination of fevers, it generally yields to tonics and purgatives. When it results from peripneumonia, brisk purgatives

and derivatives will be found most efficacious. When it is caused by measles, by catarrh, or by pertussis, the treatment must merge into that adapted for these diseases. This should not be considered a primary disease, it is rather a morbid result of other diseases.

PHTHISIS PULMONALIS.

Phthisis pulmonalis is owing to the development in the lungs of a peculiar substance, called *tubercle.*

Of tubercle.—Andral describes tubercle, at its origin, as a pale yellow, opaque, small, round body, of various degrees of consistence, in which no trace of organization or texture can be detected by the naked eye; although the microscope shows various forms of cells, imperfectly developed; so that tubercle evidently consists of unhealthy lymph, whose powers of organization are imperfect.

Seat of tuberculous matter.—The prevailing opinion among pathologists is, that the seat of tuberculous matter is the cellular tissue of organs. It may, however, be formed on secreting surfaces; as, in the mucous follicles of the intestines, on the surface of the pleura and peritoneum, and likewise in false membranes, or other morbid products, and in the blood itself.

Dr. Carswell regards the mucous surfaces as the principal seat of tuberculous matter; and asserts "that, in whatever organ the formation of tuberculous matter takes place, the mucous system, if constituting a part of that organ, is in general either the exclusive seat of this morbid product, or is far more extensively affected with it than any of the other systems or tissues of the same organ." Andral considers the cellular tissue its chief seat, but that it may occasionally occur on mucous and serous surfaces. Lombard supposes it to be restricted to the cellular tissue.

In confirmation of Dr. Carswell's statement, he has

shown it in the lungs formed on the secreting surface, and collected within the air cells and bronchi; in the intestines, in the isolated and aggregated follicles; in the liver, in the biliary ducts and their extremities; in the kidneys, in the infundibula, pelvis, and ureters; in the uterus, in the cavity of that organ and Fallopian tubes; and in the testicle, in the tubuli seminiferi, epididymis, and vas deferens. The formation and subsequent diffusion of tuberculous matter is also observed on the secreting surface of serous membranes, particularly the pleura and peritoneum; and in the numerous minute cavities of the cellular tissue. The accumulation in the lacteals and lymphatics, both before and after they unite to form their respective glands, is frequently very considerable.

Morbid Appearances and Pathology.—Tubercles in the lungs, in their earliest stage, may present themselves in three forms. 1st. The *common cheesy tubercle*, in yellowish friable masses, in more or less rounded masses, or sometimes filling one or more of the bronchial tubes. 2nd. *Miliary tubercles;* small granules, like millet seed, bluish white and semi-transparent, often found in great quantities. Some pathologists consider these as the earliest stage of the yellow cheesy tubercle; others, on the contrary, believe them to be merely some of the air vesicles solidified by chronic inflammation. But certain it is that they have some relation to the regular tubercle, as they are found in the same person and in the same parts of the lung. 3rd. *Tubercular infiltration;* the morbid matter being diffused uniformly through a tissue, and not agglomerated in masses.

Tubercle when deposited may lie dormant for a long time, without exciting any particular symptoms. In very rare and favourable cases, their softer particles may be absorbed; and nothing be left but the phosphate and carbonate of lime they contained, which may lie quietly in the lung for a whole life.

But in general, tubercle, after a time, acts as a foreign body, excites inflammation and suppuration in the neighbouring sound parts, and is expelled.

The first visible step is a *softening*, which depends most likely on the exudation of serum or pus by the surrounding lung, or by the cellular tissue, that may be entangled in the tubercle. This increases, till an abscess forms, called a *vomica*.

The vomica enlarges till it bursts into a neighbouring bronchial tube; and then, in *favourable cases*, after the expulsion of the tubercular matter and pus by expectoration, the cavity may contract, become smooth and cartilaginous on its inner surface, and at last be obliterated, and the phthisis be cured.

More frequently, however, fresh tubercle is deposited, fresh vomicæ form, and unite, till the patient's lung is riddled with cavities, and he dies exhausted. One or more bronchial tubes are found opening into each vomica.

Tubercle generally occasions some degree of pleurisy and consequent adhesion; this diminishes the frequency of what, nevertheless, happens sometimes, viz., ulceration of the pleura, and escape of the matter from a vomica, and, of course, of air into the pleural cavity; constituting a kind of *pneumo-thorax*, sometimes met with in the last stages of phthisis.

Ulceration of the larynx, tubercular deposits in, and ulceration of the intestinal glands, and a peculiar fatty condition of the liver, are morbid appearances often met with in the phthisical.

Tubercles most frequently are found in the *upper lobes*, and generally at first in the *left lung; pneumonia* in the *lower* lobes of the *right* lung.

Symptoms which mark the onset of pulmonary phthisis.—Before the signs of pulmonary tubercles are observed, we may often remark first, a tendency to simple inflammation of the mucous membrane of the air passages; secondly, one or more attacks of hæmoptysis;

thirdly, an inflammation of the pulmonary parenchyma, or of the pleura.

Inflammation of the mucous membrane of the air passages, without complication of inflammation of the pulmonary parenchyma, *which may be appreciable by percussion, auscultation, and the sputa*, is certainly the affection most frequently observed in individuals who become phthisical subsequently. In many cases, the pulmonary tubercles are to be regarded as the products of the inflammation of the mucous membrane of the air-tubes. Again, it is extremely probable that the attacks of bronchitis, so readily contracted by several individuals, far from causing the tubercles, are the effects of them.

Hæmoptysis may take place at different periods of pulmonary phthisis, and in several persons, marks, in some measure, the commencement of consumption. It is generally symptomatic of tubercles, but in some cases precedes their formation.

There is another class of patients, in whom we do not trace pulmonary tubercles either to a bronchitis or to an hæmoptysis; in them the phthisis declares itself after a pleuro-pneumonia.

Among the acute exanthemata, there is one in particular after which we frequently see pulmonary phthisis makes its appearance—that is, *measles*. The reason of this will be readily understood if we reflect that in measles, much more than in small-pox or scarlatina, the bronchi are the seat of either an active congestion or an acute inflammation.

Symptoms which appear during the progress of pulmonary phthisis.—I shall give the three stages of the affection, as described by Dr. Stokes.

In the first stage, the tubercle is developed, but not yet suppurated; in the second, small ulcerations are formed; and in the third, we have vast caverns excavating great portions of the lung.

"*First stage.*—The more prominent symptoms are

those of irritation, cough, pain, and quickness of pulse, which in certain cases are preceded, but in the greater majority followed, by an unaccountable emaciation; the cough is almost always dry during the first few weeks, unless where the tubercle has succeeded to catarrh; it may occur in every variety, but it is most commonly a slight, frequent, and irritating cough, referred by the patient to a tickling sensation in the trachea. The expectoration, when occurring, is scanty, and consisting of a thready, greyish, and nearly transparent mucus, occasionally dotted with blood; a slight wheezing sometimes accompanies the cough.

"With these symptoms the patient frequently complains of pain, which may be situated in any part of the side. In some instances, it is only felt in the lower, while in others it occupies the upper part of the chest, shooting from the clavicle to the subscapular regions, and often occupying the articulation of the shoulder, when it is often mistaken for rheumatism, or pain of hepatic disease; it occurs with various intensities, is generally remittent, and often relieved by anodyne, or slightly stimulating, applications. This pain is commonly accompanied by tenderness of the subclavicular region, and often with that irritation of the muscular fibres which causes their contraction on percussion; the respiration is slightly hurried, and the first approaches of hectic can be perceived.

"*Second stage.*—This is characterized by the establishment of decided symptoms; the emaciation increases; the pulse continues quick; the countenance becomes characteristic; the sweatings are more profuse; the cough looser, the expectoration becoming puriform, tubercular, and often bloody. The digestive system now begins to suffer; thirst, loss of appetite, and abdominal pains, torment the patient, and the first indications of the wasting and persistent diarrhœa appear; the patient feels he can lie better on one side than the other, and begins to feel pain in the opposite

side of the chest—a sure sign that this terrible disease has invaded the remaining lung.

"*Third stage.*—In this condition, the patient is often apyrexial, and the perspirations cease, particularly if the digestive system remains healthy; the pulse may be slow, though generally becoming accelerated before death; emaciation proceeds to the last extremity. The voice is sometimes lost, at others hollow and melancholy; the cough is loose, the respiration tranquil, and expectoration easy; aphthæ appear on the tongue, and spread over the cavity of the mouth; the limbs become cold; the breath gets a heavy odour, and the appetite in general fails." Life may, however, even under these circumstances, be protracted for a considerable time.

Physical signs.—These may be divided into two classes; first, those of the earlier stages, which denote the presence of *tubercles;* secondly, those of the later stages, which show the existence of *vomicæ*, besides which, there are in the last stage of certain cases the signs of *pneumo-thorax.*

Of tubercle.—When a portion of lung is solidified by the deposit of tubercle, the corresponding part of the chest will be dull on *percussion.*

Vesicular breathing will be inaudible; and instead of it the *whiffling* sound (called bronchial respiration, and arising from the passage of air through the bronchial tubes) will be heard if any such tube is enclosed in the solidified portion of lung. Before the portion of lung is so filled with tubercle as to render its vesicles *quite* impervious, there are heard a feebleness and roughness in the respiratory murmur; and the sound of *expiration* is prolonged.

The *voice* will be conveyed with unusual loudness through the solidified lung, so as to give the sensation called *bronchophony.*

But yet auscultation is far from an infallible means of judging of the existence of tubercles in their earliest

stage, and moreover, numerous tubercles, either still in a state of crudity, or already softened, may exist in the lungs; these tubercles may give rise to all the symptoms of phthisis in the second and even in the third stage, and yet the sound yielded on percussing the parietes of the thorax may not have undergone any alteration. This perfect sonorousness of the chest in phthisical patients is always observed, when the pulmonary parenchyma has retained its healthy state around the tubercles. *Increased sonorousness* may exist under three circumstances—1st. When there exists a large tuberculous cavity, into which the air enters by one or two bronchi which open into it, and the parietes of which secrete but a little liquid, so that the cavity contains more air than pus. 2ndly. Where a partial emphysema has been produced. 3rdly. When a pneumo-thorax occurs as the result of the opening of a tubercular cavity into the pleura; this occurrence is generally manifested by the sudden accession of an acute pleurisy.

When tubercular induration in the upper parts of the lung is considerable, it has the effect of conducting the sounds of the heart, with great distinctness, to the upper regions of the chest. This fact was first noticed by Dr. Townsend.

Indications of vomicæ.—First, supposing the vomica to be half filled with liquid, and to communicate freely with the air-tubes, there will naturally be heard on every entrance and exit of air, a *gurgling* sound like the bursting of very large bubbles. The same may also arise from dilatation of the bronchi, or from abscess of the lung; but these conditions, and especially the last, are rare.

If the vomica is empty of liquid, there will be heard a class of sounds called *cavernous respiration;* consisting of certain variable sounds indicating the passing of air *into and out of* a cavity.

If the vomica be partially full of liquid, the latter

may perhaps be heard to splash, when the patient coughs.

The *particular resonance of the voice* which constitutes *pectoriloquy*, is another sign of a vomica. When a cavity of moderate size and regular form, empty, or nearly so, is in free communication with a large bronchial tube, and is very near the surface of the lung in contact with the thoracic parietes, or when the intervening structure is rendered a good conductor by condensation, the voice is transmitted in the most perfect and unmodified manner, and seems to be produced in that spot of the chest, seemingly distinct from the oral voice. This is *perfect pectoriloquy*. If heard with the stethoscope, the sound of the voice seems to come through the tube, and enters the observer's ear louder than that which, coming from the patient's mouth, strikes the other ear; but the utterance is never so distinct. When heard to this degree in parts where there is naturally little or no resonance of the voice, it proves beyond doubt the existence of a cavity communicating with the bronchi.

But immense cavities may exist without there being pectoriloquy: thus, then, though this phenomenon, when it does take place, indicates the presence of a tuberculous cavity, we must not conclude from its not occurring that there are no *vomicæ*. The nature and quantity of the fluid contained in the cavity, the manner in which the bronchi open into it, and the extent of induration around it, considerably modify the pectoriloquy. We should hold in mind, that without there being any trace of tuberculous excavation, and but merely a considerable induration of the pulmonary parenchyma existing, the voice may often present a peculiar resonance, which approaches more or less to perfect pectoriloquy; it is then *bronchophony*, according to Laennec. But these phenomena being separated merely by shades, it is easy to conceive how they may be confounded.

By *imperfect pectoriloquy* is meant that form in which the voice does not seem to enter the stethoscope, but only to resound at the end. This sign cannot be relied upon when heard in the sternal half of the infra-clavian and mammary regions, the axillæ, and inter-scapular spaces.

There is yet another class of sounds to be spoken of. I said before, that the pleura sometimes ulcerates, so that a communication is formed between a vomica and the pleural cavity. In consequence of this aperture, air passes at each inspiration into the pleural cavity, whilst the lung collapses; and more or less liquid will also escape from the vomicæ. The spot where this perforation occurs, is generally, says Dr. Watson, opposite to the angle of the third or fourth rib. The indications of this state of things will be, 1st, great clearness on percussion; 2nd, complete absence of respiratory murmur; 3rd, a peculiar resonance of the voice, breathing, and cough, called by the French *amphoric resonance.* This is a sound of metallic character, and greatly resembles that produced by speaking or coughing over an empty barrel or copper boiler, or by blowing into an empty bottle: 4thly, there is occasionally a tinkling sound of a metallic character, produced by the fall of a drop of liquid from the upper to the lower part of the cavity.

Now, these four sounds, all indicating, as they do, the existence of a large cavity containing air and liquid, and communicating with the trachea, are generally caused by pneumo-thorax, as before said. But they may also, though very rarely, be caused by the presence of a very large vomica. In this case they will only be heard in the upper part of the chest, and instead of great clearness, there will be extreme dulness on percussion.

Of the sputum.—In pulmonary consumption, there is no *constant relation* between the appearances of the *expectorated matter* and the state of the lung. In

many cases, it is not at all characteristic; indeed, it may be mucous while large cavities exist in the lung, or purulent from bronchial irritation. Dr. Forbes observes—"In the earlier stage of the disease, the cough is either quite dry, or attended by a mere watery or slightly viscid, frothy, and colourless fluid: this, on the approach of the second stage, gradually changes into an opaque, greenish, thicker fluid, intermixed with small lines or fine streaks, of a yellow colour. At this period, also, the sputa are intermixed with small specks of a dead white or slightly yellow colour, varying from the size of a pin's head to that of a grain of rice, and which have been compared by Bayle to this grain when boiled. These have been noticed by many writers, from Hippocrates downwards. After the complete evacuation of the tubercles, the expectoration puts on various forms of purulency, but frequently assumes one particular character, which has always appeared to me pathognomonic of phthisis, although the more accurate and extensive observation of modern pathologists has proved the same to exist occasionally in simple catarrh. The expectoration to which I allude, consists of a series of globular masses, of a whitish-yellow colour, with a rugged woolly surface, and somewhat like little rolled balls of cotton or wool. These commonly, but not always, sink in water. This kind of expectoration has appeared to me most common in young subjects, of a strongly-marked strumous habit, and in whom the disease was hereditary. At other times, in the cases in which these globular masses are observed, and also in those in which they have not appeared, the expectoration puts on the common characters of the pus of an abscess, constituting an uniform, smooth, coherent, or diffluent mass, of a greenish, or rather greyish hue, with an occasional tinge of red (from intermixed blood), and sometimes more or less fœtid." Dr. Stokes considers the expectoration, in which the globular ragged masses here described are

expelled, more peculiarly allied to phthisis than any other. He also adds, "I do not recollect a single case in which I observed this character, that did not turn out to be phthisis."

Treatment.—In the treatment of consumption there are two grand rules—to diminish irritation or inflammation in the chest; and to support the general health and strength.

Preventive Treatment. — When persons are known to be disposed to phthisis, they should most carefully avoid every imaginable source of irritation in the chest; for a bad catarrh or pleurisy is exceedingly apt to bring consumption after it. A warm, sheltered residence; exercise in the open air, especially on horseback; and a diet calculated to keep up the strength without producing feverishness, are very important. A prolonged course of steel is often of service.

If the complaint has actually appeared, and is complicated with bronchitis, the patient must be confined to his room, and all exertion of the lung be prohibited. If he be of a robust habit, and has a full pulse, a single abstraction of blood from the arm is indicated; the bowels must be kept gently open, and the diet consist of milk, farinaceous substances, and light vegetables. But it is on local depletion and counter-irritation we must chiefly rely. Leeches should be frequently applied to the sub-clavicular and axillary regions of the affected side; the number used on each occasion should be small, and they ought to be applied alternately in each region. After this treatment has been persisted in for a short time, blisters and other derivatives are to be frequently applied under the clavicles and over the scapular ridge. Issues may also be established. During this treatment the cough is to be allayed by mild sedatives. In fine weather, horse exercise should be taken, and the invalid, to promote his recovery, *should* remove to a milder climate.

In cases where there is laryngeal or tracheal irrita-

tion, leeches should be applied over the part most affected; blisters may be then applied to the nape of the neck and to the sternum.

An individual in perfect health, or labouring perhaps under a slight cold, is attacked with copious hæmoptysis, accompanied with considerable excitement of the heart. The hæmorrhage having subsided, we find the respiration hurried and the pulse quick; the cough continues, and there may be local pain. The upper portion of one side sounds dull, and here the respiration is decidedly feeble, although generally with little crepitus. In these cases, the tubercular development is very rapid, no interval occurring from the first invasion. In a considerable number of patients, it is in this way phthisis makes its outbreak. It is not uncommon, however, to see persons whose health is perfectly re-established after a first hæmoptysis, so that it does not appear to be connected with anything serious. At the end of a longer or shorter time, a second hæmoptysis supervenes, then a third, and again they are restored to health; finally, they have a new attack of spitting of blood, and this time their health does not return; they cough, and have oppressed breathing; and all the symptoms of pulmonary consumption develop themselves.

The treatment of this form consists in subduing the hæmoptysis by proper means, and then paying assiduous attention to the condition of the respiratory apparatus, especially the upper lobes of the lungs.

Dr. Cheyne strongly recommends bleeding in the hæmoptysical variety of consumption; and in bronchial hæmorrhage, threatening consumption, he advises small bleedings at intervals of a week. He considers bleeding to be justified during hæmoptysis, or any symptom or sign of inflammation. Laennec observes,—"I shall content myself with asserting briefly, in this place, that bleeding can neither prevent the formation of tubercles nor cure them when formed. It

ught never to be employed in the treatment of con- umption, except to remove inflammation or active letermination of blood, with which the disease may be omplicated; beyond this, its operation can only tend o an useless loss of strength." Tartarized antimony, n nauseating doses, is a useful remedy. Dr. Cheyne ombines a quarter of a grain of the antimony with ifteen grains of nitre, and places much confidence in he combination.

When phthisis is complicated with *pneumonia*, we nust have recourse to frequent local depletions by eeches, continued counter-irritation, the use of setons, nd a mild course of mercury. The idea of arresting he progress of scrofulous ulceration of the lung by nercury occurred about the same time, and without ny mutual communication, to Drs. Stokes, Graves, nd Marsh. Dr. Stokes observes—"For the last few years, these gentlemen and I have treated with mer- ury several cases of incipient pulmonary disease, which in all probability would have ended in phthisis. But a great number of observations must still be made in order to establish the actual value of this practice, and it must be recollected that, in the cases thus treated, other and active means were employed to re- move the local disease."

When a *tubercular excavation* is formed, our art avails us but little indeed; in fact, all we can do is to palliate the concomitant symptoms. True it is that, in many cases of this kind, judicious treatment may prolong life for many years; in the great majority of cases, however, after a large cavity is formed, a fatal issue soon succeeds. In some cases, a healthy action is set up in the cavern, and the patient is saved; but, unfortunately, such an occurrence is exceedingly rare. The patient's best chance, under such circumstances, is afforded by the use of setons, and travelling.

On the Continent, the places chiefly frequented by *onsumptive patients* are, Hyères in the south of

France, Nice in Piedmont, Pisa, Rome, Naples, Madeira, and Lisbon. In this country, the Isle of Wight, and the various coast towns of Devonshire and Cornwall are recommended; in Ireland, the Cove of Cork, and Mallow, are considered the best places of residence for the phthisical patient. Dr. Forbes speaks favourably of Penzance; Dr. Stokes commends Torquay. In some cases, the good effects produced by a sea voyage are very remarkable.

The *palliative* treatment must be directed to the more distressing symptoms, such as the hectic fever, cough, pain, diarrhœa, &c.

Hectic fever in this disease must be regarded more as a measure of the irritation than of the suppuration of the lung; it is often alleviated by local depletions, by the occurrence of an hæmoptysis, or by regulating the diet. The patient should stay as little as possible in bed, and should sit during the day in a large airy apartment; his chest should be sponged with tepid vinegar and water; frequent changes of linen are to be provided; and the state of the digestive system should demand our attention. Sulphate of quinine has been recommended, especially when the fever assumes an intermittent character.

The pains are best relieved by leeches, blisters, and anodyne liniments. For quieting the cough, all the different forms of demulcents and narcotics have been employed; of the latter, the best are, the different preparations of opium, henbane, conium, and belladonna, especially the old *paregoric*. When the cough resists these means, a few leeches may be applied to the trachea; and in some chronic cases, where even these means failed, Dr. Stokes has seen much relief afforded, by the common anti-spasmodic mixture of camphor, valerian, opium, ammonia, and æther. This able physician justly deprecates the use of stimulating inhalations, which act in checking the secretion of the lung; and adds, "I have seen chlorine inhalations

sed in a number of cases, and always with bad effects ; resh irritations of the lung, pains of the side, tightess of the chest, sudden anorexia, diarrhœa, and sopor, ave followed its use. Inhalations of the vapour of ater, containing a narcotic extract, are frequently seful."

The diarrhœa must be looked upon as proceeding rom an enteritis, and is best treated, by attending arefully to the regimen ; in the early stages, it can enerally be controlled by the ordinary cretaceous and piate medicines, but these soon lose their effect. In he more advanced stages, the metallic astringents, ith opium, and anodyne enemata, are employed ; in ases where even these fail, decided benefit is produced y the application of a blister to the abdomen.

DISEASES OF THE PLEURA.

PLEURITIS (*Inflammation of the Pleura*). — It is nore usual to meet pleuritis alone, without being omplicated with pneumonia, than to meet pneumonia ithout pleuritis. The most striking difference existng between cases of pleuritis consists in the presence r absence of effusion. The form occurring without iquid effusion is rarely severe, unless it is very extenive ; it is the *dry* pleuritis of authors.

Symptoms.—Fever, acute pain or *stitch* in the side, urried and interrupted respiration, *dry* cough, and a ard resisting pulse, are the marked symptoms of this isease in its early stages. The pain is often intense, ll motions of the thorax increase it, and the affected ide is fixed and motionless. The patient complains f intense heat within the chest, and there is occaionally an extreme tenderness of the integuments. During the first stage, the patient seldom lies on the ffected side, in consequence of the position causing ncrease of pain. The rule generally is, that in the *irst stage he lies on the* healthy, in the second, on the

diseased side. When the diaphragmatic pleura is affected, there is generally orthopnœa; as might be expected, the respiration is more hurried and difficult during the persistence of the pain.

Pleuritis may terminate—1st, in resolution; 2nd, in effusion of lymph, forming adhesions of a more or less extensive character; 3rd, in effusion of serum forming hydrothorax; 4th, in effusion of pus, forming empyema.

When the pleura covering the diaphragm is inflamed, the distinctive symptoms are said to be,—1st, a more or less acute pain along the cartilaginous edge of the false ribs, generally extending into the hypochondria, and sometimes even to the flank; 2ndly, complete immobility of the diaphragm in inspiration; 3rdly, a very remarkable anxiety, expressed particularly by the sudden alteration of the features; 4thly, an almost constant orthopnœa, with inclination of the trunk forwards. Patients in this situation dread the slightest motion, as being calculated to awaken the most violent pain; this symptom, which is sometimes absent, is considered by M. Andral to be one of the most characteristic. The less constant symptoms are,—hiccup, nausea, and vomiting; convulsive movements of the muscles of the face, and particularly of those of the lips: delirium, which supervenes either in a continued or intermittent form. Finally, when the diaphragmatic pleura of the right side is the seat of inflammation, the liver may be sympathetically irritated and jaundice develops itself. The co-existence of this jaundice with a more or less acute pain in the right hypochondrium may induce one to believe in the presence of a hepatitis.

Physical signs.—The earliest sign of pleurisy occurring during the first stage, when the membrane is slightly roughened by lymph, is a *rubbing sound* heard during the movements of inspiration, and arising naturally from the friction of the roughened surfaces against each other. This sound is often perceptible to

the patient himself. But it ceases as soon as the opposing costal and pulmonary membranes are separated by liquid effusion.

When effusion has occurred, it is denoted by dulness on percussion of the portion of the chest corresponding to the effusion. This dulness supervening much more rapidly than in ordinary pneumonia, and unaccompanied or preceded by crepitation, generally points out pleuritic effusion. The resonance of the chest is commonly diminished first in the inferior dorsal and lateral regions, corresponding to the base of the lung. As the effusion increases, the dulness of sound gradually extends upwards, and becomes more pronounced. Sometimes the transition from the dull to the healthy sounding parts is so abrupt that a horizontal line will exactly divide them, and this, when well marked, is a very characteristic sign. A change of position will also alter this line in a manner quite distinctive, and which can happen only in liquid effusion—the dull sound always accompanying the liquid as it gravitates to the lowest parts. When the effusion is copious, the entire side, from the clavicle down, may be dull. M. Reynaud has pointed out another effect of effusion, which may furnish a diagnostic sign, in its intercepting the slight fremitus or vibration which accompanies the voice in all parts of the chest. The hand applied to a healthy chest readily feels this general vibration; but a layer of liquid, interposed between the lung and the chest, acts as a damper, and prevents the transmission of the vibration.

The respiration is usually heard becoming *bronchial*, as the effusion increases up to a certain point; but then, as the bronchi themselves become pressed by further increase, it becomes faint, and at last ceases.

Another effect of a large collection of liquid in the chest is to displace the viscera in a remarkable manner. Thus an effusion on the left side will often displace the heart, and make it pulsate under, or even on the right

of, the sternum. The liver will be pushed downwards by a large collection of fluid on the right side. These signs are important, because they distinguish this disease from hepatization of the lung, which is liable to be mistaken for pleuritic effusion, but which produces no such displacements. A useful criterion of this kind, drawn from percussion on the sternum, has been pointed out by Dr. Stokes: a copious effusion on one side will displace the sternal mediastinum, and render the whole sternum dull on percussion. A hepatized lung, on the other hand, will not encroach on the mediastinum, but, lying under one half of the sternum, will render that half dull, whilst the other half will remain resonant as usual.

Morbid appearances.—The pleura, when attacked, presents—1st, alterations of tissue; 2nd, alterations of secretion.

1st. *Alterations of tissue.*—When a person labouring under a slight pleuritis, dies of another disease, the pleura will be found to be red to a greater or less extent; but a careful examination soon shows that this redness is solely owing to the greater or less injection of the vessels which pass through the sub-serous cellular tissue; the membrane itself has retained its transparence, and no red vessel ramifies through it. Should the inflammation be more intense, the serous membrane itself then presents vessels, in greater or less number, filled with blood; sometimes these vessels, not being very numerous, leave large intervals between them, and they scarcely disturb the transparency of the membrane; sometimes their number is greater, they become agglomerated, and anastomose in various ways, so as to produce mere points, long streaks, large patches, and finally, a uniform red tint, to a greater or lesser extent; this last case is very rare. In the majority of cases, the pleura, red or white, opaque or transparent, is not increased in thickness; we very rarely find it really thickened.

2nd. *Alterations of secretion.*—The alterations of secretion presented by the inflamed pleura are more numerous and more varied than its alterations of tissue. The liquid exhaled by the inflamed pleura presents a multitude of varieties; in some cases, it consists of colourless or lemon-coloured serum, perfectly limpid and transparent; in more common instances, however, albuminous flocculi are observed to float in the limpid fluid. In other persons, there is found a liquid decidedly turbid, of a yellow, green, brown, or greyish colour, which is sometimes very thick, and as it were muddy. Finally, after several intermediate states, this liquid presents itself under the form of real pus, such as it exists in an abscess. In some rare cases, the pleura is filled with a peculiar liquid, which is neither serum nor pus; this liquid, usually deposited in compartments formed by false membranes, resembles either animal jelly half liquefied, or honey. Blood may also be effused into the inflamed pleura; but sometimes the red tinge is so slight that it is evidently merely serum, mixed with colouring matter, which constitutes the effusion. In other cases, on the contrary, the pleura is found filled with a liquid altogether resembling the blood which comes from a vein. It cannot be doubted in this case but that natural blood was really exhaled by this membrane.* The different liquids effused into the pleura are always inodorous, unless a solution of continuity of the thoracic parietes, or a pulmonary fistula, establishes a communication between the cavity of the pleura and the exterior.

When the effusion in the chest is very considerable, the *lung* exists only in the form of a thin lamina, occupying a very small space along the spinal canal; and, if it be covered with thick false membranes, one

* Besides, in the case of hæmorrhagic pleurisy (*hæmothorax*), blood may be effused into the sac of the pleura from a wound, by the rupture of an aneurism, by pulmonary apoplexy, or by a passive *transudation.*

would suppose at first view that it had completely disappeared. At other times the lung is not compressed to its entire extent towards the vertebral column; one lobe only, for instance, is compressed by the effusion. In fact, the position of the lung in these cases of effusion is very variable; it may be compressed in different degrees and directions, or it may float, free from all adhesions, in the midst of the liquid.

Treatment.—The treatment of pleuritis rests on the same basis as that of peripneumonia. When the patient is of a robust habit, and the inflammation runs high, free *blood-letting* must be employed. As soon as the pain appears, and there is as yet no effusion, *leeches* applied over the painful side often remove the disease. This effect is obtained with more certainty if general blood-letting be premised. The combination of both is extremely useful. Large emollient cataplasms should be applied to the affected side. After a full blood-letting, a brisk *cathartic* may be given, so as to act freely on the bowels, and also produce derivative effects. In most cases, it will now be advisable to bring the system under the influence of *mercury*.

In *chronic pleurisy* there is but little constitutional distress; yet the patient emaciates rapidly, the pulse is quick, and the breathing hurried. On examining the chest, one side is found dull and enlarged, the heart is displaced, and the respiration is puerile in the opposite lung.

In such cases, the patient must be confined to bed, his bowels be freely acted upon, and his diet consist of farinaceous substances. A few leeches are to be occasionally applied to the affected side, and mild mercurials are to be exhibited, so as to induce slight ptyalism. Counter-irritants are now to be employed. M. Andral recommends, "that the blister to the chest should be replaced either by a seton, the suppuration of which should be kept up for a long time, or by a moxa. As

all febrile symptoms subside, we may improve the patient's diet by allowing light broths, fresh eggs, &c.; diuretics should also be now had recourse to. In this stage, Dr. Stokes places great reliance on the internal and external use of iodine. When the absorption of the effused fluid has been effected, change of air should be recommended.

Paracentesis.—If effusion into the pleura is so extensive as to endanger the patient's life from the difficulty of breathing it occasions, or if his health and strength are giving way, it will be proper to make an aperture for the escape of the liquid, by *paracentesis.*

DISEASES OF THE HEART AND ITS MEMBRANES.

Auscultation of the heart in health.—On applying the ear to the region of the heart in a healthy person, a sound is heard at each pulsation, followed by an interval of silence. This sound is double, consisting of a dull slow sound, immediately followed by a short quick one. The first sound is produced by the contraction (systole) of the ventricles, and is synchronous with the pulse of arteries near the heart. The second, or short one, accompanies the dilatation (diastole) of the ventricles. This second sound is said to be produced by the shock caused by the tightening of the semilunar valves at the ventricular diastole. Laennec rates the relative duration of these sounds to be as follows:—The first sound, two-fourths; the second sound, one fourth, or a little more; the interval of silence, one-fourth, or a little less. These sounds are naturally most distinct in the space between the cartilages of the fourth and seventh ribs of the left side, and on the lower part of the sternum; the former part corresponding with the left, and the latter with the *right side of the heart.* Simultaneously with the first,

or systolic sound, an impulse or shock is communicated to the stethoscope. It is most perceptible at and between the cartilages of the fifth and sixth ribs, where it may be felt by the hand; but the stethoscope commonly renders it sensible in lean persons over the whole præcordia.

Morbid sounds of the heart. — Unnatural sounds may be called *murmurs;* and they are of two kinds; the *exocardial,* produced *external* to the heart, that is to say, *in the pericardium;* and the *endocardial,* produced in the heart itself.

The *endocardial* murmurs have a *blowing* character, the *exocardial* give the idea of friction.

"The endocardial murmur," says Dr. Latham, "is not only different in kind from the natural sounds of the heart, but it takes their place, and is heard in their stead. It comes exactly where the first sound, or where the second, or where both sounds should be. It keeps strict time with the systole or with the diastole of the heart, or with both.

"The exocardial murmur, too, is different in kind from the natural sounds of the heart. But it does not take the place of them; it is not heard in their stead. In proportion as it is louder, it obscures or overpowers the natural sounds. But the natural sounds are still apt to reach the ear through the exocardial murmur; and, when they do not reach the ear, it is because they are imperceptible under the circumstances, not because they cease to exist."

Endocardial murmurs (*i.e.,* murmurs *within* the heart) are caused by peculiar *vibrations of the columns of blood* which pass through the heart; and these vibrations may depend—1st, upon an unnaturally thin *quality,* and deficient quantity *of the blood,* as in the murmurs heard after hæmorrhage; 2ndly, *on disease* of the valvular *orifices* of the heart, offering obstacles to the passage of the blood.

A murmur caused by the passage of the blood

through a diseased valvular orifice may be *direct* or *regurgitant;* that is, may be produced during the flow of the blood along its natural channel, if contracted; or during its regurgitation, which will happen if the diseased valve is unable to shut properly.

In order to ascertain which valve is diseased, notice must be taken of the *time* at which the murmur is heard; of the *part* of the præcordial space *where it is heard most loudly;* and of the *direction in which it is conveyed the farthest.*

I may observe *in limine,* that valvular disease of the right side of the heart is very rare indeed; and that the diagnosis of it from disease on the left side is a matter of some uncertainty, for information on which I must refer the student to the works of Dr. Watson and Dr. Latham. The following observations, therefore, chiefly apply to the aortic and mitral valves.

When a single endocardial murmur is heard during the *systole* of the heart, its seat is most probably the aortic valve, which is thickened, so as to impede the blood in its exit from the heart and to throw it into vibration.

When a single murmur is heard, coincident with the heart's *diastole,* this also may be produced by a diseased aortic valve, if so diseased as to be incapable of closing, and so to permit the blood to *regurgitate* into the ventricle.

When there is a double murmur, both *systolic* and *diastolic,* these also may arise from disease of the aortic orifice alone; the former being a murmur caused by the flow of blood from the heart; the latter by its regurgitation.

Again, when there is a *single systolic murmur,* it may be caused by disease of the *mitral valve,* permitting the blood to regurgitate into the left auricle from the ventricle, when the latter contracts.

The spot where all endocardial murmurs are heard most *distinctly is im*mediately over the valve which

originates them. And the space under which the cardiac valves lie, may be said to be comprised *between the lower margin of the 3rd left costal cartilage, and the lower margin of the 4th*, extending inwards to the middle of the sternum. Here it is that almost all murmurs are heard most clearly.

INFLAMMATION OF THE HEART; ENDOCARDITIS, AND PERICARDITIS.—These maladies are frequently found to be concomitants *of rheumatism*. No doubt they do often occur from other causes; and they often occur, too, in slight degrees without being complained of or suspected; so that there is much left for future investigators to explore on the subject.

Symptoms.—The symptoms of endocarditis are, 1st, *pain* in the heart; 2nd, *disordered action* of the heart, which may be violent, or else feeble, irregular, and intermitting; 3rdly, some dyspnœa; and, lastly, *abnormal sounds;* beginning with a *roughness* and afterwards a murmur, arising from thickening of, or deposit on some of the valves. One or more of these symptoms, occurring in the course of acute rheumatism, may be considered a sign of endocarditis.

The pain is sometimes so slight that the patient scarcely notices it, if at all; but in dangerous cases is an extreme anguish, liable to be followed by orthopnœa, restlessness, delirium, and death. The murmur sometimes is heard at the very beginning, whilst there is no other symptom or complaint about the heart; sometimes it does not come on till the middle or end of the disease.

The symptoms of *pericarditis* are, 1st, pain in the region of the heart, augmented by pressure and by a deep inspiration; 2ndly, irregular or violent action of the heart; 3rdly, difficulty of breathing; and, lastly, the *physical signs*—an *exocardial murmur*, caused by the rubbing of the roughened and inflamed serous surfaces of the heart and pericardium against each other;

dulness of percussion over an unusually large space of the præcordial region; and sometimes a distinct undulation visible between the cartilages of the 2nd, 3rd, and 4th left ribs. The exocardial murmur resembles the rubbing of two roughish surfaces against each other—it is called by Dr. Watson the *to and fro sound;* which name well expresses its character. The dulness on percussion, and the undulation, arise from the presence of fluid effusion in the pericardium.

Pericarditis, like endocarditis, may come on in the course of acute rheumatism, without being denoted by pain, or any symptom sensible to the patient. The region of the heart should therefore be frequently scrutinized by the stethoscope in rheumatism, and proper measures be adopted as soon as there is the first indication of murmur.

Morbid appearances in acute pericarditis.—The membrane intensely red; perhaps ecchymosed, its cavity containing serum with flakes of lymph; and both the inside of the pericardium and the outside of the heart covered with a layer of lymph of variable thickness; sometimes the opposing surfaces adhere; sometimes they are free, and the lymph is flocculent, or corrugated, making the heart's surface look like tripe.

Of endocarditis.—The affected portion of the valves is generally found thickened, pink, and fringed with deposits of lymph.

Treatment.—The treatment of inflammation of the heart is the same as that of acute rheumatism, only modified to meet the emergency. *Bleeding* must be employed, if the general state of strength and excitement show it to be demanded, and that it can be borne; *cupping between the shoulders,* or *leeches to the præcordia,* are indispensable. Full doses of *opium,* at bedtime, to insure sleep; and *calomel,* with smaller

doses of opium, in such quantities as the severity of the disease may demand during the day; *purgatives*, so as to clear out the abdominal viscera, and *colchicum*, are the main remedies. And it should be observed that it will be right to leech or cup the instant any abnormal sound is heard in the region of the heart, although no symptom of uneasiness there may be complained of by the patient. When the acute state has subsided, *blisters* will hasten the absorption of effusion or deposit of lymph.

ON HYPERTROPHY, DILATATION, AND ATROPHY OF THE HEART, AND ON ANGINA PECTORIS.

Hypertrophy signifies a preternatural increase of the muscular substance of the heart; and there are generally said to be three varieties of it—viz. *Simple Hypertrophy*, in which the muscular parietes are thickened, but the cavities unaltered in size; *Hypertrophy, with dilatation*, or *eccentric hypertrophy*, in which there is also an increase of the capacity of the cavities; and *concentric hypertrophy*, in which the substance of the heart is thickened, and its cavities diminished.

But modern pathologists, and especially Professors Budd and Watson, have decided that the *concentric hypertrophy* is a pathological mistake; that, in fact, it depends on the state of contraction in which the heart happens to be left at the moment of death; and that the so-called concentric hypertrophy often vanishes as the *rigor mortis* goes off, and the heart dilates and becomes flabby.

Hypertrophy of the left ventricle may be caused, *first*, by circumstances that excite the action of the organ to a great degree; such as high living, violent exercise, and mental excitement; and, *secondly*, by obstructions of the mouth of the aorta. These, of course, require greater muscular force to be exerted in order that the

blood may be propelled in the same time through a small aperture as through one of the natural size.

Hypertrophy with dilatation is much more common under the last-mentioned circumstances than simple hypertrophy; for the same cause that obstructs the current of blood, will also give the cavity a tendency to dilate, especially if the patient has but little tone and vigour in the muscular system.

Dilatation without hypertrophy.—This is a kind of muscular atrophy, and happens to flabby cachectic patients, in whom the heart gives way and stretches in its efforts to carry on the circulation.

Hypertrophy of the left ventricle without valvular disease causes the patient to feel an unnatural beating; the pulse is full and strong, the face florid, and there is a disposition to hæmorrhage and inflammation. On auscultation, the *impulse* is felt to be strong and widely diffused; the *systolic sound* less loud and clear than natural.

Treatment.—Spare unstimulating diet, repose of body and mind; small bleedings and purgatives.

Hypertrophy of the left ventricle with valvular disease.—This is much more common than the last variety; its symptoms are much the same, except that if there is much obstruction of the aortic valves, the pulse cannot be strong or full: if the obstruction is very great, the pulse will be feeble or intermitting. The valvular obstruction will cause a blowing murmur.

Hypertrophy with dilatation of the left ventricle from valvular disease is, as was before said, much more common than simple hypertrophy; and the *greater the dilatation, the feebler will be the impulse and clearer the sound.* A great amount of dilatation, like great obstruction of the aortic valves, causes the pulse to be feeble and intermittent; the extremities cold, and a tendency to faintness.

Hypertrophy of the right ventricle with dilatation is

often a consequence of the obstruction the blood meets with from pulmonary disease.

Consequences of diseased heart.—From the obstruction the circulation meets with, various organs become congested, and ultimately diseased, whilst the serum is apt to be effused, constituting various forms of dropsy. Great dyspnœa, with more or less bronchitis, and finally hydrothorax; congestion of the liver, and abdominal viscera, or of the kidneys; blueness of the lips, and ascites and anasarca, are the general precursors of death. Sometimes the heart becomes so thin and soft that it bursts or ulcerates at one point, causing sudden death from hæmorrhage into the pericardium.

Treatment.—The treatment of permanently diseased heart must be *palliative;* whatever symptoms happen to be urgent must be relieved. The general rule is, that all violent exertion and mental anxiety, especially running up stairs, and fits of anger; all intemperance and unwholesome food must be shunned. Unwholesome food is very liable to cause distress, by distending the greater end of the stomach, and pressing it up against the heart.

If there is much palpitation, pain, and dyspnœa, with *blood to spare,* leeches or a small cupping will relieve; a belladonna or opiate plaster over the heart, and small doses of *hydrocyanic acid,* if the stomach is irritable, are the remedies. But it must be borne in mind, that if the aortic orifice is contracted, increased action of the ventricle is beneficial, and must only be kept within reasonable limits.

If the patient's condition is feeble and bloodless, and there seems evidence of dilatation, tonics, especially *steel,* given in very small doses for a long time, and a nutritious diet, are of service. The *ferrum tartarizatum* is a good form from its diuretic qualities.

Diuretics are always of immense service in heart disease, by relieving the vessels loaded with blood

which cannot pass rapidly enough through the heart. Digitalis in small doses, with squill and mercury, may be tried, especially if there is any dropsical tendency. *Purgatives* and *mercurials* for relieving abdominal and hepatic congestion are often also necessary. *Blisters* and setons to the chest may be used if there is a suspicion of any inflammatory process about the heart or pericardium. *Stimulants* and *antispasmodics*, such as ammonia, æther, henbane, &c., in small doses, often give great relief where there is palpitation, combined with nervous debility and a languid circulation.

ANGINA PECTORIS.—This dreadful complaint attacks persons who have some organic alteration of the heart, and generally of an atrophic character. In some cases the heart has been found excessively loaded with fat; in others there has been a softness of the heart; in others disease of the valves or of the aorta; and in several, *ossification of the coronary artery*, a change which would, of course, greatly interfere with the proper nourishment of the heart.

Symptoms.—These seem to be of the nature of a *cramp*, or *spasm of the heart*, combined with inability to propel its contents properly. The patient, in walking briskly, especially if he does so after a meal, is seized with a peculiar pain in the region of the heart. It is a pain of a peculiar, alarming nature to the patient, who often feels that he must stop and support himself, and as if another step would be fatal. The pain goes through to the back, and often shoots down to the elbow of the left arm. The pulse sometimes stops during the paroxysm. When it has lasted some seconds, it goes off. The attacks, generally, as the disease advances, becomes more and more frequent and violent, and more easily induced, till on some sudden exertion, the patient drops dead.

Treatment.—*This* may be comprised in the word *quiet*. *The patient* should be warned of his danger;

and the means which have been before spoken of should be employed to allay irritation of the diseased organ; taking care neither to weaken the patient too much on the one hand, nor on the other to let his veins become too full, or the liver and kidneys inactive.

HÆMORRHAGE.

Hæmorrhage signifies an escape of blood. It is divisible into two kinds: the *traumatic*, or that which arises from mechanical injury or wound; and the *idiopathic*, or that which arises from disease or internal causes.

The more *active*, or *sthenic* forms of hæmorrhage are preceded by signs of general plethora and of increased action; slight horripilations, and a frequent, full, and jerking, or bounding pulse, often ushering in the attack. There is a sense of heat, tension, fulness, and throbbing, with slight or shifting pain at the commencement, and often actual increase of temperature in and near to the seat of hæmorrhage. In the active states, the blood is florid, coagulates readily and firmly, and frequently ceases to be discharged as soon as the evacuation has proceeded so far as to remove the plethora and increased action occasioning it—the patient often feeling lighter and better from the attack.

The *passive*, or *asthenic* forms of hæmorrhage take place in feeble constitutions, and proceed from want of tone in the capillary vessels.

EPISTAXIS (*Bleeding from the nose*).—The blood is effused from the pituitary membrane, and may be discharged either by the nostrils, or by the mouth, after having passed into the posterior fauces.

Causes.—In its idiopathic states, epistaxis occurs most frequently in children and young persons. In the more mature periods of life, it is most frequently *symptomatic*, or dependent upon diseases of the heart, of the liver, spleen, or of some other viscus, or consti-

quent upon the disappearance of some sanguineous or other evacuation. The *external* causes are, injuries, irritants, exposure of the face to fires or to the sun's rays. The *internal* causes are, whatever increases the flow of blood to the head, as mental excitement, sneezing, catarrh, &c. &c.

Symptoms.—The *sthenic* form is ushered in by pain of the head, vertigo, or somnolency, with increased pulsation in the temporal arteries. The sthenic epistaxis is often *symptomatic* or *critical* of several acute diseases, especially the more inflammatory kinds of fever, and inflammations of the brain, or of the lungs, &c. The *passive* forms are frequently *symptomatic* of several cachectic maladies, and of the last stages of malignant or low fevers. The quantity of blood discharged may vary from a few drops to many pounds; and in the more obstinate passive states the patient may be reduced to the utmost danger, or may be carried off in a few hours or days, according to the continuance or violence of the discharge.

Treatment.—If the patient be robust or plethoric; if he have experienced attacks of determination of blood to the head, the discharge should not be arrested until the vascular system is relieved, and when this is accomplished, the epistaxis will cease of itself. If it seem to cease prematurely, and particularly if the above symptoms still continue, depletions, purgatives, and an antiphlogistic regimen, ought to be prescribed.

To check the hæmorrhage, the patient ought to be placed in a cool, airy apartment, with the head elevated, or held upright, and the feet plunged in warm water containing mustard. The neck should be bared, and cold fluids aspersed over it and the face, or ice applied upon the nape of the neck or upon the forehead; and an active cathartic exhibited; the sulphate of magnesia with sulphuric acid is the best. Lemonade and cooling drinks may also be given. When the epistaxis has *become habitual, or* periodic, and especially if it be

vicarious of menstruation, it may be anticipated by cupping on the nape of the neck.

In the *passive* or *atonic* states of the disease, astringents should be injected into the nostrils, and astringents and tonics given internally. If the bleeding will not stop, the anterior and posterior apertures of the nostrils should be plugged.

HÆMOPTYSIS AND PULMONARY APOPLEXY (*Hæmorrhage from the respiratory organs*).—Hæmoptysis is one of the most frequent varieties of hæmorrhage, owing to—1st, the very extensive bronchial and vesicular surface to which the blood is circulated for the purpose of undergoing the requisite changes during respiration; 2nd, to the delicate conformation of the capillaries of the mucous membrane of this part; 3rd, to the liability of the lungs to congestions, from impaired nervous power, from obstructions of the pulmonary veins and of the circulation through the left side of the heart, and from tubercular and other lesions of the substance of the lungs.

We may admit three principal sources for the blood which is expectorated in hæmoptysis. It may come, *first*, from the mucous membrane of the bronchi; *secondly*, from a vessel ulcerated in a tuberculous excavation; *thirdly*, from an aneurism of the aorta, or of the large trunks arising from its transverse arch, in which case it will be soon fatal.

Pathology.—Some few cases of hæmoptysis depend on suppression of the menses, and are habitual and not dangerous; but in by far the majority of cases it depends on disease of the heart, or on the irritation of tubercle. Hypertrophy of the left ventricle is generally supposed to be a frequent cause of pulmonary hæmorrhage; but the momentum caused by hypertrophy of the right ventricle is rarely sufficient to rupture any branch of the pulmonary artery. Dr. Watson states, "that every instance of pulmonary hæmorrhage dependent upon organic disease of the heart, which he

had observed, coincided with disease on the left side of that organ, mechanically obstructing the return of blood from the lungs. The obstacle has sometimes been placed at the entrance of the aorta; but it has most commonly consisted of narrowing of the left auriculo-ventricular orifice, and a rigid condition of the mitral valve."

When these morbid states exist, it is easily brought on by violent exercise, or anything that irritates the lungs.

Pulmonary hæmorrhage may be *simple*, the blood being all spit up; or it may be attended with what is most improperly called *pulmonary apoplexy;* that is to say, an infiltration of blood into the minute tubes and air-cells, rendering a portion of lung solid.

Symptoms.— Some degree of pain or oppression at the chest, with cough, which brings up mouthfuls of blood, fluid or clotted. The quantity may vary from a teaspoonful to several pints; so that the patient may be suffocated by the abundance of the hæmorrhage. The stethoscope is useful as indicating the extent and place of the hæmorrhage, for wherever there is blood in the air tubes, or vesicles, there will be a corresponding crepitation, or if the lung is solidified there will be absence of respiration.

After pulmonary apoplexy, the blood is expectorated in dark red sputa, mixed with mucus.

Treatment. — When the pulse is full, strong, and vibratory, bleeding is required, and the quantity of blood abstracted will necessarily depend on the strength of the patient. One blood-letting of twenty or twenty-four ounces on the first or second day, will have more effect in checking the hæmorrhage than several pounds taken away in the course of a fortnight. When the patient's powers will not admit of general depletion, cupping or leeches should be resorted to. A free current of cold air should be allowed to pass over the patient, who should be lightly covered; the bowels should

be opened with Epsom salts and sulphuric acid; and the best remedy is the acetate of lead with opium.

HÆMATEMESIS (*Hæmorrhage from the stomach*).—This disease is seldom idiopathic, or primary, but is generally the consequence of some pre-existing changes, sometimes chiefly seated in the stomach, at other times in the adjoining viscera, as the spleen, liver, or pancreas. The blood may proceed from the mucous surface of the stomach, which is most commonly the case, or from the surface of the duodenum or the œsophagus.

Symptoms.—In most cases, there are *premonitory* symptoms, such as tension or pain about the epigastrium, with faintness, or a sense of sinking, or of anxiety, at this region; flatulent or acrid eructations; lassitude with irregular chills and flushes of heat. The *pathognomic* phenomena of the disease are, nausea, followed by vomiting of blood, either fluid or coagulated, pure, or mixed with the contents of the stomach. The blood and other matters thrown up come away with more or less effort, frequently with comparative ease, even when the hæmorrhage is greatest, and seldom with much previous retching; it is sometimes gulped or eructated upwards. When the quantity of blood thrown up is great, the effort at ejecting it may sometimes occasion irritation in the pharynx, and excite coughing, and from this circumstance, cause some doubt as to the seat of the effusion; but the history of the case will easily show the nature of the disease. After an attack of hæmatemesis, the bowels are generally relaxed, and the dejections dark-coloured, from the presence of blood in them, and extremely fœtid. Sometimes the evacuations are quite black, and of the consistence and appearance of tar. This state of the evacuations (the *melæna* of old authors) often continues for some time after the vomiting has ceased; and they are often preceded by colicky pains through the abdomen, distension, flatulence, tormina, and even slight meteorismus.

Treatment. — In plethoric and robust persons, in cases depending on congestion of the liver or spleen, or upon suppressed discharges, and where there are indications of increased or sthenic action, we should have recourse to copious or repeated *blood-lettings*, according to circumstances. *Cupping* over the hypochondria, purgatives, cathartic enemata, and external *derivatives*, should be resorted to. In the more active forms, a full dose of *calomel*, followed in a few hours by a purgative draught, and this by a cathartic enema, so as to procure copious alvine evacuations, should precede the use of astringents. When the hæmorrhagic discharge is so copious as to forbid the delay which this practice would occasion, the calomel should be followed in a short time by a full dose of oil of *turpentine*, given on the surface of milk or of some aromatic water, or of this medicine conjoined with castor oil. If this draught be thrown off the stomach, it should be repeated; and it may be even again preceded by the calomel. Notwithstanding its usual nauseating effect, turpentine is generally retained in hæmatemesis, and it allays the vomiting by arresting the hæmorrhage.

Of the *astringents*, the acetate of lead, in large doses, with opium, or with pyroligneous acid, acetate of morphia, and creosote, are the most efficacious. In the more *passive* states of the disease, the tonic astringents, as the tincture of the sesquichloride of iron, the oil of turpentine with aromatics, the sulphates and sulphuric acid with opium and infusion of roses, alum in milk-whey, are generally useful.

HÆMATURIA (*Hæmorrhage from the urinary organs*). —*Symptoms.*—The source of blood voided through the urethra may be either the kidney, ureters, bladder, or urethra. When it proceeds from an affection of the kidneys, it is attended with a sense of heat and pain in the loins, and sometimes with coldness of the extremities, *and the blood is intimately mixed with the*

urine. When the disease is in the ureters, there is a sense of pain and tension in their course; *and coagulated shreds of fibrine, having the shape of the ureters, are frequently voided.* When the hæmorrhage is from the bladder, it is usually preceded by heaviness and tension above the pubes, extending to the perinæum, groins, and lumbar regions; the passing of the urine is attended with pain and difficulty; the blood is little, if at all, combined with the urine. When the hæmorrhage is from the urethra, pain is felt in a particular part of the canal, and the blood is red, liquid, and pure, and generally is voided *guttatim.* When the blood, however, flows back into the bladder, some uncertainty as to its origin is produced.

Hæmorrhage of the urinary organs presents little worthy of notice as regards its *physical characters*, except when it occurs in the bladder. In this organ, it takes place from isolated points of the mucous membrane, which, as well as its sub-cellular tissue, presents a number of deep red patches, varying from a line to half an inch in diameter, the larger ones having often a small ash-coloured slough in their centre. These patches consist of blood effused into the mucous and sub-mucous tissues, and are accompanied by venous congestion of those tissues where the effusion has not taken place. This form of hæmorrhage is chiefly observed in injuries of the spine; and appearances perfectly similar sometimes follow the application of blisters to the chest, abdomen, and other parts of the body. The most frequent cause of hæmorrhage from the urinary organs is the presence of the fungoid disease in the prostate, and hence its much greater frequency in the male than in the female.

Treatment.—The treatment of this affection will, of course, depend on its seat and cause. When the hæmorrhage is from the kidney, if the patient be strong, and the pulse full, either general or local depletion, with the usual antiphlogistic treatment, is requisite.

On the contrary, when the patient is debilitated, as in typhus or scurvy, the urine being generally alkaline, the mineral acids should be given. In ordinary cases, when neither excitement nor depression is present in a marked degree, small doses of copaiba, or of the *tinct. ferri sesquichlorid.*, the latter of which is the best, are to be administered. The avoiding of all stimulants, and absolute rest, should be insisted on.

SCURVY AND PURPURA.—These are constitutional diseases, attended with great disposition to hæmorrhage through an unhealthy state of the blood.

The *symptoms* of both are much alike. The skin presents marks of ecchymosis arising from effusion of blood into the cellular tissue, which may be caused by very slight violence or pressure: and there is more or less hæmorrhage from the mouth, lungs, bladder, or intestines. Sometimes it occurs in the brain and proves fatal.

Sea-scurvy is caused by want of fresh vegetables in the diet, and may be cured by administering them: especially lemon-juice and potatoes.

Purpura is a disease whose causes and conditions are obscure. It occurs sometimes to persons who have, sometimes to those who have not, suffered privation; sometimes it is attended with great debility; sometimes with feverishness, and a sthenic condition of the whole system.

Treatment.—If there is much fever, and headache, or signs of congestion in any important organ, it will be right to bleed cautiously; but the most useful and important remedies are active purges, which usually clear away plenty of foul secretions from the intestines. Saline medicines, or tonics, must be prescribed according to circumstances, and the diet also be regulated so as to supply the wants of the system, without loading it too much.

OF DROPSIES.

DROPSY is rarely a primary disease; it is most frequently the result of organic disease of the heart, liver, or kidneys, or of some one of the serous membranes, particularly the peritoneum, and occasionally follows scarlatina. Mechanical obstructions to the circulation, such as the pregnant uterus, tumours in the pelvis, &c., will cause dropsical effusions.

In general dropsy (anasarca) the fluid is effused into the general cellular tissue of the body, as well as into the cavities; but in local dropsies, the fluid is at first confined to the diseased cavity, but frequently extends and becomes general. Anasarca, or general dropsy, is recognised by the swollen state of the limbs, body, and face, especially the eyelids; the swelling pits on pressure, and the depression remains for some time after the pressure is removed. The skin is rather pale and semitransparent; the breathing is much oppressed, the sleep restless, the appetite bad, and the strength much impaired.

Treatment.—The use of cathartic and diuretic medicines is recommended, and will frequently cause the removal of the effused fluid; but where this is caused by organic disease, the relief can be but temporary, until the latter is removed by appropriate treatment.

The serous membranes are most liable to the collection of serum in their cavities, as in hydrocephalus, hydrothorax, hydrops pericardii, ascites, &c. When the quantity of serum effused into the peritoneum is large and the distress of the patient urgent, the operation of paracentesis, or tapping, is performed, and generally in the linea alba, about midway between the

pubes and umbilicus. After the operation, the use of pressure by means of a bandage has been found useful, although rarely successful. In like manner, paracentesis thoracis is performed, to afford relief in hydrothorax. A successful case of tapping the pericardium is related by M. Aran, physician to the Hôpital St. Antoine, Paris, in which, after the fluid had been withdrawn, a mixture containing a solution of iodine was injected into the cavity. The operation and injection were repeated, and the second time with success.

ENCYSTED DROPSY.

HYDROPS OVARII (*Dropsy of the Ovary*).—The ovaria are subject to several diseases, as dropsy, scirrhus, vascular sarcoma, atrophy, and the formation of fat, hair, teeth, and bone; of these, however, dropsy is by far the most common.

Ovarian dropsy is the most frequent species of encysted dropsy, and is of the greatest importance in a practical point of view. It is very often complicated with other organic changes in the ovaria, peritonæum, uterus, and tubes; but it also frequently consists, only or chiefly, of a collection of a greater or less quantity of fluid in one or more cysts, into which the substance of the ovarium seems to have been converted, owing to the enlargement of one or several of them giving rise to atrophy of the proper structure of the organ. The disease is most common between the ages of twenty and fifty. It often follows abortions, and is frequent in sterile women.

Symptoms.—These are very obscure until the cyst enlarges so as to be felt externally, when the presence of fluctuation may be usually detected; its being circumscribed, and its position on one side of the abdominal cavity, distinguish it from ascites.

The *fluid* contained in ovarian cysts varies remarkably. *In some cases,* particularly when it is lodged in

one, or a few cysts of large size, it is serous, or mixed with ropy mucous matter. In others, it is dark coloured, and resembles coffee. Where the cysts are more numerous, their contents are generally thick, gelatinous, and of a brown colour of varying depths of shade. The fluid is also, but more rarely, of the appearance and consistence of custard, and occasionally it resembles honey. The quantity of fluid which collects, particularly when there is only one cyst, and when its contents are serous, is sometimes enormous. Weper, Haller, Monro, and Frank, have found as much as 120 pounds of fluid in a single cyst, and Müller, as many as 140 pounds.

Treatment.—But little can be done by medicine for this disease; the various preparations of iodine are the most useful.

Paracentesis in some instances becomes absolutely requisite, owing to the urgency of the symptoms; but it often accelerates a fatal issue, by inducing inflammation of the sac; numerous examples of this could be adduced. Dr. Denman, therefore, justly observes, that paracentesis ought to be deferred as long as possible. It has been proposed to inject the cyst. The *extirpation* of the tumour has been attended with favourable results in many cases of late years, but it should be performed early.

DISEASES

OF THE DIGESTIVE ORGANS

AND

THEIR APPENDAGES.

PSEUDO-MEMBRANOUS INFLAMMATION.

Muguet is an inflammatory affection of the mucous lining of the alimentary canal, which is characterized by the presence of a white adherent layer, somewhat similar to the adventitious membrane of coagulable lymph. It occupies principally the superior portion of the canal, the gums, tongue, pharynx, &c., and is attended with fever and disordered bowels.

APHTHÆ (*Thrush*) are very common in children, and sometimes prevail to a great extent in crowded hospitals, where they seem to be endemic. In some cases, they produce no general disturbance of the system, are few in number, and disappear within five or six days; they consist of small round white specks or patches scattered over the tongue and lining membrane of the mouth, and sometimes the fauces.

The application of the mel boracis will generally remove the aphthæ when local; but when produced by constitutional disease, this will require treatment.

In some forms of the disease microscopic parasitic plants are said to produce it; the use of the sulphate of soda, ℥i. to ℥i. of water, will usually destroy the plant, and cure the disease. See Tanner's *Practice of Medicine.*

In adults, aphthæ occasionally occur towards the close of phthisis and other debilitating diseases.

CYNANCHE TONSILLARIS.—The most frequent cause of common inflammation of the tonsils is, exposure to cold damp air—hence it prevails with inflammation of the pharynx, at certain seasons of the year.

Symptoms.—This disease is easily detected by the tumefaction, pain, and redness of one or both tonsils, which are covered with white spots, or an inflammatory crust. There are, moreover, pain on deglutition, dryness and heat in the fauces, and general fever.

Treatment.—Bleeding or leeches, purgatives, calomel, cooling gargles of nitre, muriatic acid, &c., poultices to the throat, followed by stimulating liniments or blisters, and the inhalation of steam, will soon reduce the inflammatory tumefaction and give relief. In acute cases, scarification of the glands is useful. Chronic enlargement of one or both tonsils may ensue. In such cases, extirpation of the gland has been practised with success.

DIPHTHERIA OR DIPHTHERITE.—This is a severe and frequent form of cynanche tonsillaris, which has recently shown itself in this country; it differs from the common sore throat in its great tendency to cause sloughing of the tonsils, and in the exudation of coagulable lymph, which forms a coating on the tonsils and fauces, and frequently extends into the larynx. In its various symptoms and history it resembles scarlatina, excepting that the rash is not present, although in some cases an efflorescence of an irregular character appears on the skin. Its treatment is the same as that for scarlatina.

INFLAMMATION OF THE PHARYNX, OR SORE THROAT, may be easily detected by an inspection of the pharynx, which presents a dark-red colour, frequently spotted with whitish patches. It is attended with more or less fever.

Treatment.—Leeches may be applied externally to

the neck, and the bowels should be freely opened by active purgatives. At the commencement, the inhalation of steam affords most relief; as the inflammation subsides, recourse may be had to astringent or stimulating gargles, and good diet.

GASTRITIS (*Inflammation of the mucous membrane of the stomach*) may be either chronic or acute. The latter, however, is very rare.

Causes.—External violence; and cold drinks taken whilst the body is heated.

Symptoms.—Heat, and acute pain, increased on pressure over the stomach, or by coughing, or deep inspiration; instant vomiting of the matters ingested; constipation, and prostration of strength. The pulse is usually quick, small, and irregular; the tongue clean, and red at the point or edges. The skin is hot and dry; there is thirst, and a desire for cold drinks. This disease is attended with great depression of the heart's action through the influence of the *solar plexus* of the great sympathetic. As it advances, the face becomes collapsed, the extremities cold, and the patient lies in a state of complete prostration; cerebral symptoms now supervene, the abdomen becomes tympanitic, hiccough appears, and death soon closes the scene.

Treatment.—Blood must be freely drawn from the arm in severe cases, and the venæsection repeated according to circumstances; leeches, also, may be applied over the epigastric region, followed by warm fomentations and counter-irritants, and the exhibition of mercury.

CHRONIC GASTRITIS is an occasional cause of the severer forms of dyspepsia, and is often attended with one or more *ulcers* in the stomach.

Symptoms.—Pain and uneasiness about the region of the stomach, particularly increased after meals; sense of constriction in the œsophagus, near the lower part of the neck; imperfect digestion, accompanied

by eructation, nausea, and occasional vomiting of food, or of mucus streaked with blood; skin dry, but not warm; pulse nearly natural, but sometimes accelerated; tongue covered with a whitish fur, or red at the tip and edges, or dotted with red spots from development and injection of the papillæ. The patient often exhibits symptoms of hypochondriasis, and the spirits become low as the disease advances.

Treatment.—Attention to diet, good air, and exercise, will be more efficient than the use of medicines, which should be of a mild unirritating nature. Drastic purgatives should be avoided, and mercury, except as an alterative, should not be used. Tonics, steel, and cold bathing, in the protracted form, will be found useful. The nitrate of bismuth is a valuable remedy in this disease.

DYSPEPSIA.—Dyspepsia signifies any derangement of the functions of the stomach. It may be temporary, and depend on mere functional derangement, or may be a consequence of the most serious organic disease.

Causes.—Irregularities of diet, the use of debilitating substances, indulgence in spirituous liquors, mental emotions, suppression of accustomed discharges, &c.

Symptoms.—The following are the most prominent, but they differ according as the attack is acute or chronic.

Acute dyspepsia generally arises from the ingestion of irritating food, producing fœtid eructations, nausea, and occasional vomiting; colicky pain of the abdomen; diarrhœa. The tongue is foul and loaded, the patient suffers from a "sick headache," and a variety of secondary symptoms present themselves. The stomach should be emptied by a gentle emetic, and this is to be followed by an aperient.

Chronic dyspepsia assumes a variety of forms, and requires an infinite variety of treatment. The best is that recommended in Chronic Gastritis.

DYSENTERY.—Dysentery is an inflammation of the colon and rectum, with much pain and spasm. It most commonly prevails in warm climates, when men are collected together in large numbers. It may, however, occur sporadically in the acute or chronic form.

Causes.—Exposure to cold damp air, acrid indigestible food, spirituous liquors, and exposure to unwholesome exhalations. It prevails most in autumn, and is held by some writers to be contagious.

Symptoms.—General febrile excitement, nausea, vomiting, griping pains about the umbilical region, frequent, painful, straining, ineffectual efforts to pass stools; heat of skin, frequent pulse, thirst, heat and pain about the anus, anxiety, and prostration of strength. The dejected matters are various: in the commencement, the stools are often bilious; but the evacuation of fæces soon ceases, and nothing is passed but small quantities of bloody mucus, intermingled with pus or shreds of albuminous matter.

If the disease be not checked, the abdominal pain becomes more fixed, the pulse is feeble and extremely quick, the strength fails, the dejections assume a very fœtid character, delirium supervenes; and the patient sinks at a period varying from fifteen to thirty days. The disease may terminate unfavourably by ulceration, gangrene, or the extension of the inflammatory action to the peritonæum.

Morbid appearances.—Dysentery consists essentially in an inflammation of the mucous and sub-mucous coats of the large intestine. The mucous coat is more or less injected in several points, and certain portions of the cæcum and colon are either ulcerated or entirely disorganized, the membranes hanging by shreds into the interior of the bowel. The ulcers are sometimes small and numerous; at other times they are elevated, hardened, and covered with sloughy or fungous granulations. *Some parts* of the great intestine may be

in a state of sphacelus, and more or less coagulable lymph, mixed with shreds of disorganized cellular tissue, adheres to different points of its surface.

Treatment.—Calomel and opium to salivation is the most efficient treatment in the acuter forms, and especially of warm climates. The chief remedial means in the beginning of the disease, are, local or general bleeding, with fomentations to the hypogastrium; calomel and Dover's powder at night, and castor oil with laudanum in the morning; and starch enemata, so as to clear out all irritating fæcal matters, and soothe the bowels.

CHRONIC DYSENTERY may either succeed the acute form or it may commence with diarrhœa, and gradually assume the character of dysentery. The symptoms are the same as those of the acute form, merely differing in intensity. The alvine discharges are more copious, but less frequent; they contain less blood, and less fibrinous matter.

Treatment.—Local depletion, aided by counter-irritants and diaphoretics, must be cautiously employed. Some place their chief reliance on small and frequently repeated doses of ipecacuanha; others advise the administration of astringents, such as the infusion of catechu, the sulphates of zinc or copper, and the superacetate of lead. The last is frequently employed in combination with opium and ipecacuanha. Tonics may also be given with advantage in the chronic stage, particularly when the disease assumes an asthenic form. Those generally administered are, cinchona and the infusions of serpentaria, calumba, or simarouba barks.

DIARRHŒA consists in the copious and frequent discharge of alvine evacuations, which are generally fluid, without tenesmus or fever.

Causes and Treatment.—The causes of diarrhœa are very various, and so must be the treatment adopted for various cases.

1st. *Inflammatory diarrhœa;* this arises from irri-ation, inflammation, or ulceration of the intestines, nd is a frequent attendant of fever, phthisis, &c. It is haracterized by pain, tenderness, thirst, and slimy vacuations; and is to be relieved by small doses of yd. c. creta, and pulv. ipec. c.; injections of starch nd laudanum; rubefacients or fomentations to the bdomen: chalk mixture, &c.

2nd. Diarrhœa from *unwholesome food,* or *irritating ubstances,* or foul accumulations in the intestines, is a ery common form, being often produced by unripe ruit. This form of diarrhœa tends to work its own ure, which is best accelerated by a dose of rhubarb nd magnesia or castor oil, followed by chalk mix-ure.

3rd. *Diarrhœa* from *debility* and *relaxation.*—This orm is apt to follow any of the others, and is to be ecognised by the kind of constitution to which it hap-ens, and by the freedom from active symptoms. The arious vegetable and mineral astringents with opium re the remedies.

4th. Diarrhœa in *young children* often arises from he irritation of weaning, teething, &c. A very small lose of hydr. c. creta with rhubarb, followed by chalk nixture with five or ten minims of paregoric, are the emedies. Baked flower or biscuit powder may be ried as food.

In all cases of diarrhœa it is important to attend to he skin, and to keep it warm.

CHOLERA MORBUS. — *Causes.*—Costiveness; expo-ure to changes of temperature; indigestible food; putrid miasmata; certain seasons.

Symptoms.—Violent griping pains, followed by fre-uent vomiting, and purging of greenish bilious mat-er; spasms of the abdominal muscles, sometimes extending to the legs and arms; tongue dry; urine high-coloured, scanty, or suppressed; thirst urgent; pulse frequent, but soon becomes small and weak. As

the disease continues, the spasms become more severe, the countenance anxious and collapsed; the strength is much reduced, and fainting occurs.

As cholera morbus depends on simple irritation of the mucous lining of the alimentary canal, the morbid appearances after death are not very remarkable, consisting in some injection or congestion of the vessels.

Treatment.—Calomel and opium should be administered in a full dose, and then repeated injections of gruel or starch in large quantities to bring away the irritating matters;—and opiates. Warm fomentations may be applied over the abdomen, or the turpentine or ammoniated liniments. When the surface of the body becomes extensively cold, and symptoms of exhaustion appear, it will be necessary to administer stimulants, as camphor, ammonia, small quantities of brandy, &c., combined with aromatics.

ASIATIC CHOLERA. — This disease is endemic in India, but sometimes extends to Europe and other parts of the globe. It is supposed to be contagious and propagated by atmospheric influence.

Symptoms.—There is generally a *premonitory diarrhœa*, with occasional nausea, slight cramps, and heaviness about the head. In other cases, it commences suddenly with violent vomiting and purging (not of bile as in common cholera) but of a rice-coloured fluid, with excessive and painful spasms of the abdominal and other muscles; the pulse is quick, small, and soon disappears altogether; the skin is cold; the features collapsed; the urine altogether suppressed. As the vomiting and purging continue, the powers of life quickly fail; the extremities become deadly cold and of a bluish colour; the pulse ceases to be felt at the wrist; the breathing is laborious; and the patient, who gets very restless, is generally carried off within ten or twelve hours.

Treatment. — Calomel and opium, acetate of lead, opium, bleeding, the salts of soda and potash, cold

water, stimulants, &c., are used in this disease, and with various results. The spasms are treated with various liniments, turpentine, warm fomentations, &c. When the first symptoms have subsided, a stage of reaction often succeeds, attended with symptoms of a typhoid character, which are treated as laid down under the head of typhus fever.

COLIC—is characterized by severe griping pains in the bowels with costiveness (sometimes with diarrhœa), and frequently with vomiting. Colic may be produced by a variety of causes, the most common amongst which are, irritating ingesta, flatulency, or a morbid sensibility of the mucous membrane.

Symptoms. — The pain is not increased by pressure, nor is there any fever, which distinguish the disease from peritonitis and enteritis; it comes on in fits, and in the intervals there is perfect ease; it usually comes on quite suddenly; the muscles of the abdomen are often retracted; the patient also complains of borborygmi, or rumbling noises from the flatus in the canal.

Treatment. — Calomel or blue pill and opium with warm cordial medicines, and warm fomentations to the abdomen, are most to be depended on; to be followed by aromatic or purgative medicines to relieve the bowels. Hernia is often confounded with colic. In all cases the inguinal and femoral regions should be carefully examined. The first care of the practitioner should be to determine, if possible, the exciting cause of the colic, and whether it be occasioned by an organic disease, such as hernia, intus-susceptio, tumours, &c. This done, and the complaint having been ascertained to be simple colic, he may at once administer anodynes combined with cordials, and proceed to evacuate the intestinal secretions by the use of enemata and mild purgatives. For this latter purpose, the blue-pill will be sufficient, or castor-oil with laudanum, or the tincture of hyoscyamus may be given, either by the mouth or

in enema. The abdomen should also be fomented with the decoction of poppy-heads.

COLICA PICTONUM (*Painter's Colic*).—*Cause.*—Exposure to the poison of lead. M. Andral considers lead colic as a neurosis, in which the spinal marrow and abdominal plexuses of the great sympathetic appear to be the peculiar seat of lesion. The constipation seems to depend either on the abolition of the contractile motion of the intestines or on the suspension of the secretion of the intestinal mucus.

Symptoms.—Violent pain at the umbilical region; sickness, and obstinate constipation; pains in the wrists, ankles, and neck; headache; bitter eructations; and occasionally paralysis of some of the voluntary muscles.

Treatment.—The administration of purgatives with opiates, such as calomel and opium, followed by castor oil and laudanum. A warm bath should be given, and Dr. Wilson injects a large quantity of warm water into the bowels whilst the patient is in the bath.

Dilute sulphuric acid, which may be mixed with beer or made into a kind of lemonade, and extreme cleanliness, are the best preservatives from the poison of lead.

Paralysis of the limbs sometimes accompanies lead colic, and remains after the removal of that disease. Here great attention must be paid to the bowels, and on the least indication of costiveness the purgative salts should be administered. Dr. Pemberton speaks highly of the effect produced by supporting the paralytic limb in splints.

ILEUS—Is a violent form of colic dependent generally on a mechanical obstruction of the intestinal canal, or intus-susceptio. It is treated as the preceding operations have been proposed for the removal of the intus-susceptio; but are rarely available, as the seat of the obstruction cannot be ascertained. Sometimes the enclosed portion of the gut will slough away, and the patient recover.

PERITONITIS—is an inflamed state of the peritoneum, whether lining the intestines, the abdominal parietes, or both.

Symptoms.—Acute pain, commencing at a particular part of the abdomen, and gradually extending over the rest of the surface; heat of skin; frequency and smallness of the pulse; in many cases, nausea and vomiting; constipation; anxious countenance; tongue dry, but not foul; respiration accelerated and costal; urine scanty. The patient lies on his back, with the thighs flexed, and cannot bear the slightest pressure on the abdomen, which becomes tumid or tympanitic. In addition to these general symptoms, others will present themselves, according to the vicinity of the part inflamed to any of the principal abdominal viscera. Peritonitis from intestinal perforation is characterized by the suddenness and the rapid progress of the symtoms, and the great accompanying prostration.

Treatment.—Blood-letting, leeches, and warm fomentations, with calomel and opium, are alone to be depended on. In peritonitis from perforation of the intestinal canal, the only hope of saving the patient lies in the instant administration of opium in doses sufficient to arrest the peristaltic motion of the bowels, and admit of the adhesive inflammation.

ENTERITIS.—This term signifies inflammation of the serous and muscular tunics of some portion of the intestines; the point most frequently attacked being the termination of the ileum.

Treatment.—The symptoms and treatment are similar to those of the preceding, from which it is rarely to be distinguished.

CHRONIC PERITONITIS, AND TABES MESENTERICA.—Chronic peritonitis is sometimes a sequel of the acute disease; sometimes, on the contrary, it begins in a very obscure and insidious manner, and is attended in scrofulous subjects by a deposit of granules or tubercles external to the membrane.

Symptoms.—Slight occasional abdominal pains, often scarcely noticeable, increased by pressure; fulness and tension of the belly, particularly a deep-seated tightness, as if the integuments and muscles glided over the tight and thickened peritonæum; feverishness and emaciation.

This disease is often attended by enlargement of the mesenteric glands, with which it is usually identical in symptoms.

Treatment.—Occasional leechings, blisterings, frictions, and flannel bandages to the abdomen; or warm fomentations and poultices, if the pain is very severe; nourishing diet, small doses of mercurials, and mild laxatives and antacids.

WORMS.—There are three species of worms which most commonly inhabit the intestinal canal—viz., the *ascaris lumbricoides, ascaris vermicularis,* and *tænia.*

The *lumbricus* is a round worm, varying in length from four to ten inches; the tail ends in a blunt point; the head is sharp, and set between three oblong tubercles. The *ascaris vermicularis* is very thin, and does not exceed an inch in length, but is usually shorter; the tail terminates in a fine point. It inhabits the rectum. The *tænia* is a very long flat worm, articulated, and furnished with four suckers at the head. Two species of *tænia* are met with in man.

Worms very frequently exist in the intestinal canal without producing any irritation or inconvenience whatever; on other occasions, however, they are attended with the following symptoms:—disgust of food, or irregular appetite; nausea, vomiting, griping pains in the abdomen; tenesmus, disturbed sleep; irregular accessions of fever; diarrhœa; with slimy stools; foul breath; headache; dilatation of the pupils; strabismus, and, in young children, cerebral disturbance, or convulsions. Ascarides often produce a sensation of itching about the anus, while the lumbricus occasions pains of a gnawing character in the umbilical

region. The stools should be constantly inspected, for the presence of the worm in them can alone render us certain of the correctness of the diagnosis.

Treatment.—The objects of treatment are, to destroy and expel the parasitical animal. Common purgatives will sometimes suffice. Should these fail, we may employ the dolichos pruriens, or turpentine. M. Raspail regards camphor as a specific against ascarides; and in France and Italy the root of the pomegranate is employed with success in cases of tænia.

ACUTE HEPATITIS. — *Causes.* — External violence; hepatic calculi; suppressed secretions; influences of climate; duodenitis, &c.

Symptoms.—General febrile excitement; lancinating or dull pain of the right side, increased on full inspiration; a sympathetic pain is also sometimes felt in the right (very rarely in the left) shoulder, and along the neck. Sense of uneasiness at the stomach, and nausea or vomiting; short, dry cough; hiccup; bowels constipated; pulse frequent and hard; and the urine high coloured. The patient commonly lies on the right side, and the skin is often tinged with the yellow colour of jaundice. Rigors indicate suppuration.

Treatment. — General blood-letting; leeches, or cupping over the region of the liver, with calomel and opium, are alone to be depended on.

CHRONIC DISEASE OF THE LIVER.—This is denoted by more or less pain and tenderness, or weight and fulness in the right hypochondrium, with sallowness of the skin, emaciation, and depression of the spirits. It may be a consequence of acute inflammation, or of long residence in unhealthy climates, or of disease of the heart; one very frequent cause is *intemperance.* Sometimes the liver increases greatly in bulk, and may be felt low in the abdomen, or its limits be ascertained by percussion. Sometimes, on the contrary, it is shrunken and atrophied.

One common form of disease, which is often a pre-

cursor of ascites, is what is called the *hob-nailed liver*. This disease originally consists in an inflammatory thickening of Glisson's capsule, which forms a sheath for the portal vessels, the hepatic artery, and biliary ducts. The thickening of the cellular sheath may compress the biliary ducts, and so cause jaundice, or the portal veins, and so cause ascites. Finally, the thickened cellular sheath shrinks and becomes atrophied, and by its shrinking compresses the hepatic artery and so causes general atrophy of the organ; whilst by its shrinking, it leaves the lobules projecting as little rounded eminences like the heads of nails.

The appearance called *nutmeg liver* is a mere consequence of congestion. If after death the hepatic vessels, which run in the centre of each lobule, are injected, the liver presents on its surface numerous red spots, with pale interstices. If, on the contrary, the portal system only is injected, it will display pale spots, corresponding to the lobules, with red interstices.

Abscess in the liver may burst either externally, in which case the liver first adheres to the parietes of the abdomen, so as to prevent the escape of the pus into the peritoneal cavity; or in less fortunate cases, it may burst into the pleura, or peritonæum, or lung, or intestines, generally with a fatal result.

Treatment.—The general rules in treating chronic hepatic disease are, to diminish congestion of the portal vessels; to keep up the secretion of urine, to allay irritation, and support the strength. Small doses of mercury with squill; saline aperients, and diuretics; taraxacum; sulphate of manganese; muriate of ammonia; iodine; calumba, and other light tonics; nitro-muriatic acid, given internally, and used as a bath for the legs; occasional leeching, blistering, or frictions with mercurial ointment, or with iodine; Cheltenham waters; and a light nourishing diet, are the main remedies.

JAUNDICE—is characterized by a yellowish tinge of

the skin and eyes, depending on the presence of bile in the circulating fluids.

Causes.—Diseases of the liver; obstruction to the free passage of bile into the duodenum; congestion of the portal system, or excessive secretion of bile; gastro-duodenitis, &c.

Symptoms.—In addition to the yellow tinge of the skin and eyes, the digestive functions are deranged; the bowels usually costive, and the fæces untinged by bile; the urine is high-coloured and more or less of a saffron tint; the tongue is foul, and covered with a yellow fur; the patient complains of headache, and very often of pain in the region of the liver. The condition of the pulse is extremely variable, and the skin is usually dry, with a sense of itching or stinging.

Treatment.—Mercury combined with warm purgatives is the best remedy. For jaundice depending on spasm of the biliary ducts, full doses of opium, aided by warm bath, and hot fomentations to the abdomen, will be found advantageous.

GALL-STONES are generally found in the gall-bladder, or biliary ducts; they vary in size, number, and shape. They are composed of the colouring matter of the bile, and of cholesterine.

Symptoms.—Biliary concretions often pass into the duodenum without causing any disturbance; on other occasions, the patient is suddenly seized with acute pain in the right hypochondrium, increased on the slightest motion, and shooting backwards under the scapula; the pain is increased after meals. There are also nausea, vomiting, distension of the abdomen, and alternations of diarrhœa and constipation. The paroxysms occur at irregular intervals; the pulse is commonly natural, and the skin cool.

Treatment.—Opium in full doses, with the warm bath, will give most relief whilst the stone is passing into the intestine. Blood-letting is also recommended, *but must be used* with caution.

SPLENITIS. — *Symptoms.* — General fever; pain in the left hypochondrium increased on pressure, and during inspiration; short, dry cough; nausea, and vomiting; constipation, and sometimes tumefaction over the affected organ.

Treatment. — The remedies most commonly employed are, local blood-letting, mercurials, iodine, and counter-irritation. The bromide of potassium has recently been recommended in the treatment of chronic enlargement of the spleen, a frequent attendant upon ague.

DISEASES

OF

THE URINARY ORGANS.

NEPHRITIS—or inflammation of the cortical substance of the kidneys, is caused by cold; blows in the region of the kidneys; violent horse exercise; powerful diuretics, as cantharides, turpentine, copaiba.

Symptoms.—High inflammatory fever; quick and hard pulse; acute burning pain in the region of one or both kidneys; with thirst, anxiety, restlessness, colicky pains, constipation of the bowels, nausea, and vomiting; retraction of the testicle, and numbness down the inner side of the thigh. The urine is at first of a deep red colour, but afterwards becomes limpid and colourless, and is sometimes not secreted. In *idiopathic nephritis*, the pain is less acute than in *symptomatic;* retraction of the testicle, or numbness down the thigh, are not so liable to occur in the idiopathic form.

Treatment.—Bleeding, locally and generally, according to the strength of the patient; the hot bath, or hot fomentations over the region of the kidney; calomel, alone, or combined with opium or hyoscyamus, with warm diluent drinks. When it is of a gouty type, colchicum has been found useful; and in these cases, mustard cataplasms may be applied to the feet. When the high inflammatory action has been subdued, counter-irritation should be had recourse to.

Nephritis occasionally terminates in the formation *of an abscess;* and in this case the symptoms are—

rigors, followed by exacerbations of fever, and sweatings, and all the usual symptoms of hectic fever. The urine becomes loaded with pus, or purulent mucus, which produces great irritation in the bladder and urethra. In other cases, the urine remains clear; the patient complains of a dull pain in the region of the kidney, with a sense of fulness and weight in the loins. This indicates the formation of an abscess, which, after a greater or less interval, opens into the cavity of the kidney, and is discharged with the urine.

Treatment.—When inflammation is absent, anodynes, either given internally or used in form of enemata or suppositories, may be used. The compound tragacanth powder may be given, and the uva ursi has been found useful. Stimulating diuretics are contra-indicated. The diet should be light, and easy of digestion. Hard water should be avoided.

Desquamative Nephritis—is a morbid condition of the lining membrane of the tubuli uriniferi, characterized by the shedding of the epithelium of the mucous membrane, which is carried off with the urine, and is found there in detached portions. The *symptoms* are general fever, with a frequent desire to pass the urine, which is scanty, of a dark smoky colour, and highly albuminous; under the microscope, it is seen to contain masses of coagulated fibrous blood corpuscles, epithelial casts, and occasionally crystals of lithic acid.

Dropsy is a common attendant on this affection.

The treatment consists in the use of diluent drinks, the warm bath, and active purgatives, avoiding mercury and diuretics.

Some authors describe both an *acute* and *chronic* form of this disease. The symptoms and treatment are similar.

This affection is one of the sequelæ of scarlatina, and is analogous to the desquamation of the general

cuticle, so frequent after this disease. It is rather a symptom of weakness than an independent affection.

Fatty degeneration of kidney, or Bright's disease.—This is an asthenic affection, characterized by gradually increasing debility, inflammation of the serous membranes, anasarca, and finally coma, and dissolution. It is caused by cold, bad diet, and intemperance, or may be the result of the preceding.

The urine is scanty, highly albuminous, and of a low specific gravity.

There is no medicine to be relied on in this affection. A regular diet, with starch, sugar, or fatty particles, should be insisted on.

DIABETES—is characterized by an increased quantity and saccharine condition of the urine. It attacks generally the elderly; its causes are, exposure to cold, privation, and other debilitating circumstances.

Symptoms.—General low fever, attended with debility. This can scarcely be considered a disease of the kidney, as the saccharine matter is found in most if not all the secretion, being produced by a defect in the assimilating functions, and most probably of the stomach and liver, and pulmonary organs.

Treatment.—Opium, cod liver oil, creosote, the salts of iron, are recommended with much effect. The diet should be animal food, and as nutritious as possible.

The urine is of a pale straw or greenish colour. Its smell resembles that of *sweet whey* or new milk. Its taste is saccharine. Its sp. gr. varies from 1·030 to 1·060. In some cases, the quantity of urine voided in twenty-four hours has amounted to *thirty pints.*

CYSTITIS.—*Symptoms.*—Severe burning pains, with throbbing, a sense of constriction and tightness in the hypogastric region; pain, which is increased on pressure, constant desire to pass the urine, and if a little be passed it is of a deep red colour and high sp. gr., with general constitutional disturbance.

Treatment.—*Blood-letting*, both general and local,

by means of cupping, or the application of leeches to the pubic region or perineum. Warm fomentations or the warm bath immediately after bleeding. Calomel and opium in full doses should be given, and the bowels should be kept open by mild laxative enemata. Where the pain is excessive, anodyne enemata should be administered. The patient should drink bland mucilaginous fluids.

Chronic cystitis frequently comes under the surgeon's notice, as a consequence of stricture or stone. It is attended with secretion of ropy mucus, ammoniacal urine, &c.

ASPHYXIA.—*Asphyxia*, according to its etymology, should be defined, the cessation of the action of the heart. As at present understood, however, it means "those cases of the cessation of the heart's action which arise from a particular cause, the interruption of the respiration, or to speak more correctly, the interruption of the effect produced by that function on the blood."

The following division of asphyxia, by Savary, and many other modern writers, will illustrate these ideas:—

1. *Asphyxia from mechanical impediments to respiration*, as by compression of the chest and abdomen, and seen in cases of a large quantity of ground falling on persons digging, &c.; by air entering into the cavities of the chest or abdomen; by a wound of the diaphragm, &c. 2. *Asphyxia from want of power in the respiratory muscles*, as from a division of the spinal cord; from lightning; from cold, &c. 3. *Asphyxia from want of air*, by rarefaction; by suffocation; by submersion; by strangulation. 4. *Asphyxia from want of respirable air*. And, lastly, 5. *Asphyxia from irritating or deleterious gases.*

PART VII.

PRINCIPLES OF MIDWIFERY.

MENSTRUATION AND ITS DISORDERS.

WHEN woman arrives towards maturity, and as long as she continues capable of child-bearing (except during pregnancy and suckling), there occurs a monthly discharge from the uterus, familiarly known by the name of the *menses*.

This discharge is invariably preceded by symptoms indicating determination of blood to the generative organs; such as pain and weight in the back; aching of the thighs; swelling and tenderness of the breasts; and often with considerable headache, and disorder of the stomach. These symptoms are mitigated when the discharge is fully established.

Physiologists have differed as to the *nature* of the fluid discharged. Some have supposed that it is not real blood, and that it is destitute of fibrine, and incoagulable. But others, with more probability, believe it to be real blood, only impaired in its vital properties by slowly trickling through the vagina, and by being mixed with its acid secretions. The quantity discharged has been variously estimated at from two to six ounces; but it is often more. Why it recurs at intervals of four weeks is unknown. Dr. Power, Mr. Girdwood, and Dr. Lee, have called attention to the *fact, that the nisus* of menstruation is often accompa-

nied with rupture of one of the Graaffian follicles, and the formation of a *corpus luteum*.

The most common disorders of menstruation are, 1st, *Emansio mensium*, or the non-appearance of the discharge at the proper age. 2ndly, *Amenorrhœa*, or *suppressio mensium;* the suppression of the menses after they have been duly established; 3rdly, *Menorrhagia*, or too profuse menstruation; 4thly, *Dysmenorrhœa*, or difficult and painful menstruation.

1. *Emansio mensium.*—The age at which girls menstruate for the first time may vary from nine to twenty-one, or later; but, in most instances, in this climate, fifteen may be said to be the average.

In the second place, the menses may not appear because of organic deficiencies; absence of the ovaries or uterus, &c. In this case the individual will exhibit no sexual passion throughout life, and it is of course irremediable.

3rdly. The menses may be formed; there may be a monthly *period* with all the symptoms; but they do not appear outwardly, because of a closure of the canal of the uterus or vagina, with imperforate hymen. In this case the uterus generally swells, and forms a tumour, containing a large quantity of dark treacly blood; and a proper examination per vaginam will decide the case. Relief must be given by an incision.

4thly. The menses may be absent through disorder of the health; and this disorder may assume two forms, the *sanguine*, and the *atonic*.

In the *sanguine* variety, the girl is often *apparently* robust, red in cheeks, and fat; and at the monthly periods there are severe headaches, with sickness; aching of the back and thighs, but no discharge. The bowels are very irregular, the appetite bad, and hysteric fits are frequent. If this variety lasts long enough unrelieved, it is sure to pass into the other, or *atonic*.

The *atonic* form of *emansio mensium* has received

e common name of *chlorosis*, or green sickness, from e green, pallid, puffy, waxen hue of the features. is a state indicative of a great lack of constitutional gour. *Red blood* is very deficient. The lips, eyes, ngue, &c., are very pale; but *serum* seems abundant, id the ankles often pit from œdema. The appetite is ry deficient or depraved: chalk, cinders, wax candes, suet, flour, slate pençil, vinegar, and other rubsh, being greedily devoured, whilst there is no relish r wholesome food. The bowels are very torpid. If is state continues, there next occur violent hysterical mptoms: and afterwards, obstinate pains, simulating flammation in the head, chest, or abdomen, or joints, hich, if treated by lowering measures, infallibly get orse.

Treatment.—In the *sanguine* variety, great advange is derivable from active purgatives, with a mild it regular course of *steel*, and *leeches* applied to the sides of the thighs, at the times when anything like menstrual *nisus* is felt.

In the *atonic* variety the bowels must be kept regur; and the best purgative is *aloes* in different forms, id especially if combined with *steel*. Electric shocks assed across the pelvis; foot or hip baths, containing ustard; horse exercise, &c., are alse useful for the tter purpose. The diet should be good and plain. ssafœtida and shower bathing will often relieve nerous and hysterical symptoms.

2. *Amenorrhœa*, or suppression of the menses, may e caused by frights or sudden shocks, or taking cold uring the menstrual period; or by the patient falling ito a low weakly state of health. It has the same wo varieties as the *emansio mensium;* which require ie same treatment correspondingly.

3. *Menorrhagia*, or profuse menstruation, is of several kinds. It may be *active* and *inflammatory*; ith bounding pulse, dry tongue, and hot skin; or it ay be *passive, with* feeble pulse, and pale cold skin;

or it may be *nervous*, being brought on by anything that suddenly alarms or shocks the nervous system.

It is liable to be attended with great *headache;* and there is one kind of headache, very deceptive to the young practitioner, which is apt to occur when the patient's veins have been largely drained, and to resemble an inflammatory attack; but if treated by lowering measures it becomes much worse.

For the active menorrhagia, if the patient is of very strong constitution, bleeding, saline purgatives, and antimony, may be required; afterwards, the acetate of lead, in grain doses, combined with distilled vinegar, and a few drops of laudanum. For the passive variety, alum, with dilute sulphuric acid, or the ergot of rye, in five-grain doses. For the nervous variety, the lead and opium, with opiate suppositories or injections. In all cases, perfect rest, in the horizontal posture, should be observed, and cold be applied to the pubes.

4. *Dysmenorrhœa.*—This affection entails very severe suffering on the patient; for the menstrual periods are attended with excruciating pain. It is generally divided into three forms, the *nervous*, the *sanguine*, and the *mechanical*.

The *nervous variety* is attended with very severe pain, but not with any symptoms that can be called really inflammatory, nor with any swelling or alteration of the womb. The discharge is apt to be capricious in quantity and quality—sometimes scanty, sometimes profuse; pale, or the reverse; but the most notable alteration in it is, the admixture of membranous shreds, like boiled gooseberry-skins. Very violent headache and vomiting are frequent symptoms. The causes of this state are, mental emotions, cold applied during the period, violent fatigue, &c.

The *treatment* of the paroxysm consists in administering opium, by mouth and rectum; castor-oil and laudanum; warm bath; large doses of ammoniated tincture of guaiacum, and the other remedies adapted

r allaying pain and spasm. During the interval, the eatment must be directed to the general health. A urse of chalybeate mineral waters, with general at-ntion to the state of the stomach and bowels, is lvisable.

The *sanguine* variety is attended with real inflam-atory symptoms, and a swelled condition of the rvix uteri, and should be treated by leeches to that art, borax and hyoscyamus, salines, and small doses mercury.

The *mechanical* variety is said to arise from stricture f the os uteri, which impedes the exit of the menstrual ischarge. The use of the bougie is necessary in such ases.

VICARIOUS MENSTRUATION.—Sometimes when the enses are absent, there is a supplemental discharge of lood from the stomach, nostrils, or rectum, or from a ound. The only thing to be done is to *treat symp-ms*, and to endeavour to restore the normal dis-harge.

LEUCORRHŒA.—This, in the ordinary sense, is a ischarge of mucus from the vagina, arising from ebility, and attended with severe aching in the back, nd other signs of languor. It is best treated by cold ponging, shower bathing, steel, and other tonics. eucorrhœa sometimes assumes an acute inflammatory haracter, and may be confounded with gonorrhœa; he colour and odour of the latter, with the more evere symptoms present, will distinguish it from leu-orrhœa.

Leucorrhœa generally depends on inflammation of he cervix uteri, attended with discharge, white, gluey, nd clear, but sometimes milky, and sometimes clear nd thin, like serum. Examination by the speculum will detect the cervix uteri swollen; the vesicles of Naboth enlarged; and perhaps one or more superficial ulcerations. These are to be treated by the applica-tion of lunar *caustic*; leeches should be applied to the

cervix; astringent injections be administered, and mild purgatives with steel be given.

CESSATION OF MENSTRUATION.—This occurs at various periods in different women—ranging from thirty-eight to fifty-five; but forty-five may be called the average. It is often attended with various disorders of the health, such as headaches, giddiness, and other signs of irregular distribution of blood: and the discharge is usually very irregular, now profuse, now scanty, now missing a month, before it ceases altogether. During this important epoch, or *turn of life*, as women call it, the health is to be kept up on general principles; and precaution to be taken both against debility and plethora.

SIGNS OF PREGNANCY.—When a healthy woman, between the ages of fifteen and forty-five, experiences a cessation of the menses, morning sickness, swelling of the breasts, and enlargement of the abdomen, the suspicion is, that she is pregnant.

When we analyse the symptoms of pregnancy, we find that they may be divided into two classes, the *rational* and the *sensible*. The *rational* are those from which, without investigating the state of the uterus itself, we reason or infer that the woman is pregnant; the *sensible* are those signs of the presence of a fœtus, detected by exploration of the uterus itself.

The *rational signs* are, 1st, cessation of the menses; 2nd, morning sickness; 3rd, the state of the breasts; 4th, quickening; 5th, the state of the urine, salivation, capricious appetite, discoloration of the vagina, and other variable signs that some important change is going on in the constitution.

The *sensible signs* are, 1st, enlargement of the abdomen; 2nd, what is called *ballottement;* 3rd, the state of the cervix uteri; 4th, the pulsations of the fœtal heart; 5th, the sound of the placental circulation; 6th, the movements of the fœtus. We must discuss each of these signs separately.

RATIONAL SIGNS.—1. *Cessation of the menses.*—This
i generally the first token by which a woman believes
erself to be pregnant; but although *generally a true*
gn, it is *very frequently* a *fallacious* one. For, in the
rst place, pregnant women may have a discharge re-
ɔmbling the catamenia, during the term, or at least for
ıe first two or three monthly periods. In the second
lace, they may be absent from disease, when there is
o pregnancy. Again, girls may become pregnant
efore they have ever menstruated, and women soon
fter one pregnancy, before the menses have returned.

2. *Morning sickness.*—During the early months of
regnancy an attack of sickness and retching at first
ising from bed in the morning is very common. It
ıay last only for a few minutes, or may be so severe
nd permanent as to interfere seriously with the nu-
rition of the patient. It may begin, too, either imme-
iately after conception, or not till the fifth or sixth
reek. It generally ceases about the third month, but
ometimes lasts longer. This is a good sign of preg-
ıancy, but not to be depended on alone; as it rises
rom the sympathy of the stomach with the uterus,
nd consequently may be caused by many varieties of
rritation of the latter organ, besides pregnancy.

3. *The state of the breasts.*—About two months after
onception, signs of vital activity generally manifest
hemselves in the breasts. They become larger and
notty, and feel aching or tingling; the *areola* round
he nipple darkens; the follicles become excessively
leveloped; and a small quantity of milky fluid oozes
ut. But these signs by themselves are not to be
elied on entirely; for the breasts generally increase in
'olume during menstruation; the darkened areola is
ometimes not noticeable in pregnant women of light
omplexions, and is sometimes present in virgins; and
he secretion of milk is not even a decisive test of sex,
nuch less of pregnancy.

4. *Quickening.*—What is quickening? Some authors

say it is the peculiar sensation caused by the first movements of the fœtus; others assert that it is caused by the sudden rise of the womb from the pelvis into the abdominal cavity. But whichever theory be adopted, it is a peculiar faintish sensation usually felt about the fourth month, sometimes earlier, sometimes later. As a sign of pregnancy, it is almost valueless, because women may be deceived, and fancy they feel it when they do not, and the practitioner has no means of testing the truth of their assertion.

5. During pregnancy, a peculiar substance, analogous to casein, which has received the name of *Kiestein*, is almost invariably present in the urine; the appetite is often capricious, and attended with strange *longings*, as is popularly known; the bladder is generally irritable; the stomach loaded with acidity; the blood rich in fibrine, and there are other variable signs of activity in the constitution. The vagina is generally of a deep purple colour. These signs merely afford corroborative evidence.

SENSIBLE SIGNS.—1. *Enlargement of the abdomen.*—This is obviously the most prominent of the sensible signs of pregnancy. It usually begins to be perceptible about the end of the second month, and consists of an equable enlargement, which gradually increases. (It must be mentioned, however, that in some few cases the abdomen becomes even *flatter* during the first few weeks of pregnancy, on account of the womb sinking in the pelvis). In the fourth month the fundus uteri may often be felt distinctly in the hypogastrium; in the fifth, it may be felt halfway between the umbilicus and the pubes; in the sixth, the tumour reaches the umbilicus, and begins to cause the navel to project, instead of being seated in a hollow; in the seventh and eighth months, it rises still higher towards the ensiform cartilage; and in the ninth it attains its maximum elevation, and sinks again in the last fortnight before delivery.

The tumour formed by the enlarged womb is firm, elastic, well defined in its outline, and not lobular. It is distinguished from ascites, by the fact, that the most prominent part of the tumour is always *dull on percussion;* whilst if the patient lie on her back, percussion will elicit a clear sound all round and behind the tumour; in fact, where the bowels are.

Swelling of the abdomen is a most important sign of pregnancy, but yet, since mere swelling may also be a consequence of *ascites;* of *enlarged liver* or *spleen;* of *ovarian dropsy;* of *tympanites;* and of *fœcal accumulations in the colon,* the practitioner must be on his guard, and must take care to investigate every concomitant symptom before pronouncing his sentence.

2. *Ballottement.*—This is a very valuable sign of pregnancy, inasmuch as it proves, physically, that *a something is suspended in the womb, floating in a liquid.* It is ascertained thus:—Let the patient be in the upright, or at least, semi-recumbent posture. Place the left hand upon the fundus uteri, and introduce the forefinger of the right hand to the cervix uteri; then jerk the right forefinger upwards, and the fœtus will be felt to *bob* down upon it two or three times. This test is most available about the fifth and sixth month.

3. The *state of the cervix uteri,* as ascertained by vaginal examination, is a very important sign. In the virgin state, this feels *hard,* small, and pointed; in the first month of pregnancy it becomes softer and larger, and the transverse slit more open. In the second month the cervix can be easily reached by the finger; its edges have lost their lip-like figure, and now form a ring—smooth in the primipara—rugged in multiparæ—around the os uteri. As pregnancy advances, the cervix becomes shorter, higher up, points to the upper part of the sacrum, and at last becomes merely a smooth globular mass, with a soft ring in its *centre. These changes* in the cervix, and the increased

volume of the womb itself, as detected by examination *per rectum*, are the surest, because most direct, signs of pregnancy in the early months.

4. *The pulsations of the fœtal heart.*—Careful examination of the front and sides of the abdominal tumour, after the fifth month, will hardly fail to detect the pulsations of the heart of the fœtus—if it be alive—beating generally at the rate of 150 in a minute, and sounding like a watch under a pillow. These pulsations are entirely independent of the maternal circulation.

5. *The sound of the placental* and *uterine* circulation may usually be detected by the stethoscope low on the sides of the abdomen, after the fourth month. It is a peculiar blowing sound (placental soufflet), corresponding to the maternal pulse.

6. *The movements of the fœtus* can usually be felt by the practitioner on putting a cold hand upon the patient's abdomen, after the sixth month. But they may sometimes be simulated by the movements of flatus, or by contractions of the abdominal muscles.

DISORDERS OF PREGNANCY.—The *morning sickness*, unless very violent, is to be looked upon as rather beneficial than otherwise; but should it be so severe as to exhaust the patient's strength, it should be checked. A combination of one drachm of sulphate with ten grains of carbonate of magnesia, given every four hours in green mint water, till the bowels are freely moved, will often check it; but should it persist after the bowels are well opened, recourse may be had to bismuth, with magnesia; small doses of hydrocyanic acid, or effervescent draughts of citrate of potass. Should it appear to degenerate into a mere habit, the mineral acids with light bitters and ether are of service; and food only of the mildest quality, such as rusks, biscuits, and small quantities of milk, or of weak brandy-and-water, should be taken in small quantities and at regular intervals.

Heartburn and *acidity* require nearly the same treatment as the morning sickness; but if they are *not* attended with sickness, a tumbler of warm chamomile tea, with a pinch of salt in it, to act as a mild emetic, will be of infinite service in clearing away a load of bile and acid matters.

The *obstinate constipation* which often attends pregnancy must be counteracted by a light diet, and by the daily use of the mildest aperients and enemata.

Diarrhœa generally arises from an irritating condition of the bile, and should be treated, first, by Dover's powder and hyd. c. cr., then by castor oil and laudanum, and lastly, by aromatic confection and other astringents.

Tooth-ache is a common source of annoyance during pregnancy, but it may generally be relieved by aperients and alkalies, followed by sedatives and tonics. If one tooth is extracted, some other one will probably begin to ache, and there is a risk of causing abortion from the shock.

Violent cough, palpitation, and other anomalous disorders during pregnancy, are to be treated on the same principles. If there seems to be *really* an inflammatory state, with *blood to spare,* and this is not relieved by acting on the secretions and excretions, blood should be taken in moderation, but never to faintness, because faintness is liable to induce abortion.

ABORTION AND PREMATURE LABOUR. — *Abortion* is said to occur when the womb expels the fœtus before the latter is capable of maintaining an independent existence—that is, before the *seventh month.* It is true, that a fœtus has been known to survive when born earlier than this; but such cases are exceptions.

Premature labour signifies the expulsion of the ovum before the full term of pregnancy has expired, but after the child has become *viable.*

The *causes* of abortion and premature labour are *infinitely various* and numerous, and include almost

every agency capable of acting injuriously on the health of the mother, and through her on the fœtus. The most common are — mental emotions, such as fright and violent anger; intense pain, syncope; diarrhœa, and tenesmus, and of course the action of violent purgatives; the ergot of rye; great fatigue in walking, or straining; violence applied to the womb externally; the discharge of the liquor amnii; the existence of tumours in the womb, or of any other state of inflammation, or impaired nutrition, &c.

The manner in which these influences act is, either by destroying the child's life, in which manner syncope, syphilis, and mercurial salivation, seem to act; or by causing the womb to contract; or by producing hæmorrhage between the uterus and placenta, which of course interferes with the nutrition and circulation of the latter, and must ultimately destroy the child, and cause uterine contraction.

The *symptoms* of abortion are, *pain* of an expulsive character, and *hæmorrhage*. The earlier it occurs, the less, in general, will be the risk and violence of the symptoms.

Treatment.—This embraces two distinct points: first, if there is a probability of preventing the expulsion of the ovum, and of enabling the woman to go on to the proper term; and, secondly, if this is hopeless, and it becomes expedient, to shorten the process, and prevent further hæmorrhage.

The *preventive* treatment, which it will be right to adopt, if the pain and hæmorrhage are only slight and of short duration, must be determined by the causes and by the condition of the patient. If she is plethoric and inflammatory, with full bounding pulse, a small bleeding; abstemious diet, small doses of mag. sulph. in infus. rosæ c.; the application of cold to the pubes; perfect abstinence from stimulants in every shape; and liq. op. sed. in sufficient doses to relieve pain. In cases not attended with plethora, the patient should

have a nourishing, but mild diet; should be forbidden to drink large cups of hot tea, and should take dilute sulphuric acid with opium, or with small doses of alum. In *all cases*, confinement to the recumbent posture, on a hard cool bed, is indispensable.

If the hæmorrhage goes on to an injurious length, and the ovum is not discharged, it should be withdrawn by the finger, or expelled by the ergot of rye.

When a patient has once miscarried, she should be carefully watched during her next pregnancy, in order to rectify the disorders that led to it on the former occasion. If, as is commonly the case amongst the higher and middle orders in towns, there is a compound of weakness and irritability, the pure air of the country, small doses of chalybeates, any mild means to insure regular action of the bowels, and tepid or cold sponging, or shower bathing, will be of infinite service.

DURATION OF PREGNANCY.—This has been a fruitful source of contention amongst physiologists; but it seems now pretty generally agreed that it is as nearly as possible 40 weeks, or 280 days, but may extend to 300 days. So that when a practitioner wishes to calculate as nearly as he can the time when delivery may be expected, he should reckon 280 days from the last day of the last menstruation; and the event will, in all probability, occur within a week of this time.

NATURAL LABOUR.—This consists in the expulsion of the fœtus into the world by means of the contractions of the uterus, aided by the diaphragm and abdominal muscles.

The process may be conveniently divided into two stages: 1st, from the commencement of labour to the complete dilatation of the os uteri; secondly, from that time to the birth of the child.

The premonitory symptoms of labour are, the subsidence of the abdominal tumour, some slight mucous discharge from the vagina, and some degree of increased irritability of bladder and rectum.

Then come on the *pains;* that is, uterine contractions; and the characteristic of true uterine contractions is, that they are dull, and *not very agonizing* in character; that they are felt chiefly in the *back and loins;* that they cause the womb to feel *tight and hard* as a cricket-ball: and, in particular, that they are *regular* and *intermittent;* that is, coming on at tolerably equal intervals, and *succeeded by perfect ease.*

On examination during the *first* stage, the os uteri may be felt high up against the upper part of the sacrum; if the finger is introduced during a pain, the bag of membranes is felt tight; on waiting till the pain has passed off, it feels relaxed, and the presenting part of the child may be ascertained.

As the pains continue, the os uteri opens more and more; the bag of membranes begins to protrude through it during the pains; and there is a *show* or discharge of mucus, streaked with blood. At last, the os uteri becomes completely dilated, so much so as to be able to slip over the child's head; which complete dilatation is often attended with violent shiverings or sickness, and then the *second stage* begins.

The pains now begin to appear not so confined to the womb; they acquire a far more *expulsive* character, and are attended with strong bearing-down efforts of the abdominal muscles. The membranes now usually break, and the child's head enters the vagina. It is then gradually propelled through this passage to the os externum; it distends the perinæum as if it would burst it, and at last slips suddenly out, being soon followed by the body and limbs.

Now there mostly occurs an interval of rest, varying from five to ten or thirty minutes, in which the womb contracts upon the placenta, and either expels it entirely, or brings it so low, that it may be easily withdrawn by the fingers. It is generally rolled up into a ball, with its fœtal surface outwards; and its expulsion is followed by many clots of blood.

Treatment of natural labour.—One of the first duties of the practitioner must be, to ascertain the *presenting part*, by vaginal examination; and to take the opportunity of estimating the capacity of the pelvis and other circumstances, which may influence the duration of the labour. He will, if he regards his own time or comfort, take care to have the rectum thoroughly unloaded by means of an enema, if the bowels have not been moved by some aperient very shortly before: he must keep up the patient's spirits, and encourage her to walk about; he must take care that she has the opportunity of making water at proper intervals; must not let the pulse flag for want of support; nor yet allow the patient to be dosed with stimulants if she has no need of them. If the anterior lip of the os uteri gets down between the head and the pubes, towards the end of the first stage of labour, he should push it back gently over the head with two fingers—a proceeding which, if nicely accomplished, will soon be followed by the more effective expulsive pains of the second stage. When the head distends the perinæum, this part should be carefully supported by one hand, applied in such a way as to delay the passage of the head slightly, and to bear it towards the pubes. When the child is entirely born, one ligature, composed of a skein of stout thread, should be tightly tied round the funis, at a distance of three inches from the navel, another an inch further on, and then the cord should be divided between them, the accoucheur taking care to see what he cuts. The child is now to be delivered to the woman in waiting, and the mother may be refreshed with a little warm tea, or wine-and-water. The accoucheur should then place his left hand on her abdomen, to grasp and support the uterus, and thus accelerate the safe expulsion of the placenta; and as soon as this has descended so low that he can with his right forefinger feel the insertion of the funis, he may withdraw it by *gentle traction in the* axis of the vagina. The pudenda

should now be gently dried, and covered with warm napkins, which should be interposed between the woman and her wet and bloody clothes, and a broad bandage fastened completely round the stomach; she should be covered up so as not to feel chilly, and then left to have half an hour's rest, whilst the nurse is washing the baby, before her night-clothes are changed, and she is made comfortable in bed.

SPURIOUS PAINS. — There is one source of trouble and delay in the early stage of labour, which is so common, that it may well be mentioned here by itself; and it is this, that the *pains*, or *uterine contractions*, seem to undergo a metastasis from the womb to some neighbouring part; and, as the accoucheur may readily see, they lose all the characteristics which have been before described as those of genuine uterine contractions. For, instead of being dull, they are most excruciating in character; instead of being felt in the back, they may affect the bladder, rectum, or hips; instead of intermitting, they are continuous, with hardly an interval of ease, and they cause little or no hardness of the womb. The treatment is simple: the bladder should be emptied, and the rectum cleared by an enema; incessant friction should be kept up over the painful parts, and, if necessary, small doses of opium with ergot of rye be administered.

DIFFERENT KINDS OF PRESENTATION.—That part of the child which is nearest to the os uteri, and first felt by the accoucheur's finger, is called the *presenting part*.

Presentations may be divided into two great classes —the *natural* and the *unnatural*. Natural presentations are those in which the long axis of the child corresponds to the long axis of the womb. Unnatural presentations are those in which the child lies across the womb. In natural presentations, either the *head*, or the *nates*, or *feet* present. In unnatural presentations, the *shoulder*.

PRESENTATIONS OF THE HEAD.—We may begin this part of our subject by a reference to the dimensions of the female pelvis, and of the corresponding parts of the child's head.

	Antero-Posterior.	*Transverse.*	*Oblique.*
Brim of the Pelvis...	4 in.	5	5¼
Cavity	5	4½	
Outlet	4	4	

The antero-posterior diameter of the outlet of the pelvis admits of being increased one inch by the recession of the os coccygis. A deduction of a quarter or half an inch must be made for all these dimensions, to allow for the soft parts lining the pelvis.

It is generally agreed, that no *full-grown* child can be born alive, if the antero-posterior diameter is below three inches; that the forceps also cannot be used in a pelvis of less than this dimension; and that the perforator should not be employed when the antero-posterior diameter is less than two inches.

The dimensions of the child's head are thus given by Dr. Churchill, to whose excellent work on the "Theory and Practice of Midwifery," the student may be referred for further information.

Longitudinal diameter (*occipito-frontal*)	4 to 4½ in.
Transverse (*bi-parietal*)	3½ ,, 4 ,,
Oblique (*occipito-mental*)	5
Perpendicular (*fronto-mental*) ...	3½
Transverse diameter of shoulders)	4¾ ,, 5½ ,,
——————————— hips.....	4 ,, 5 ,,

'Natural presentations," says Dr. Rigby, "con- of two classes; those where the cephalic, and those re the pelvic end of the child presents; in the first , it will be a presentation of the cranium or of the ; in the second, of the nates, knees, or feet."

e *cranium* may present at the brim of the pelvis,

in various positions; some authors making as many as eight varieties; but, for all practical purposes, it will suffice to consider them as four.

In the *first*, or most common position, the head is placed obliquely at the brim of the pelvis, in such a manner that the forehead lies towards the right sacro-iliac synchondrosis, and the occiput towards the left acetabulum. If the finger is introduced, and the os uteri is sufficiently dilated, it may detect the line of the sagittal suture running obliquely across the pelvis; on tracing it towards the left, it divides into two other sutures—viz., the two divisions of the lambdoidal; whilst traced backwards and towards the right, it terminates in the anterior fontanelle, an open space where four sutures terminate. The part which is nearest to the finger, and consequently first felt, is the *right parietal protuberance*. As the head is brought lower by the expulsive action of the womb, it preserves nearly the same obliquity, the upper and back part of the right parietal bone being expelled first; and the child's face, when the head is born, looks towards the mother's right thigh.

In the *second* position of the cranium, the occiput is turned towards the right acetabulum; in the *third* position, it is turned towards the right sacro-iliac synchondrosis; and in the *fourth*, towards the left. In the second position, the head passes through the pelvis in the same manner as in the first, *mutatis mutandis;* in the third and fourth, the occiput gradually turns round, as parturition advances, till it comes into a position corresponding to the first or second.

DIAGNOSIS OF DIFFERENT PRESENTATIONS.—The *head*, when presenting, may be distinguished by its hardness and roundness, and by the sutures which intersect it.

The *face* is softer and more irregular, and may be distinguished by the *nose*, which crosses the os uteri

in the same way that the sagittal suture does in cranial presentations.

The *nates* may be distinguished by the coccyx, behind which may be felt the sacrum, and before it the anus.

The *inferior extremities* may be recognised by the peculiar shape of the feet, or knees.

The *superior extremities* may be detected, by noticing the peculiar shape of the shoulders, axilla, or elbow; the thumb will not only enable the accoucheur to distinguish the hand from the foot, but also the right hand from the left. When the presenting part is so high up that it cannot be felt, and the bag of membranes protrudes conically through the os uteri, and on rupture of them an unusual quantity of water is discharged, a shoulder presentation may be suspected.

ON LINGERING LABOUR.—The process of parturition may not be completed within the usual period of time, from several reasons—some depending on the mother, some on the child. The first cause I shall specify is—

Feeble and irregular action of the womb.—When this exists, there is a great interval between the pains; and when they do come, they are short, and have little or no effect on the child. This state of things is not common in women of delicate, sluggish constitution; and within certain limits is not of much consequence, except inasmuch as it is a severe tax on the patience both of the parturient woman and of her accoucheur; but when it continues, and seems liable to exhaust the patient's strength and spirits, active interference is requisite. In some cases it may be right to give an opiate, so as to recruit the strength by sleep, and in *all*, a stimulating enema will be beneficial. But *the* remedy is the *ergot of rye*, a remedy which seems to possess a power of certain, direct, and powerful action on the womb, causing it to contract

almost unremittingly till its contents are expelled. It may be administered either in the form of *powder*, or of *infusion* made on the spot, or of *tincture;* the last is, perhaps, the most efficient and convenient form of administration. The dose is from fifteen grains to half a drachm; but the best plan seems to be, to give it in repeated small doses—such as a quantity equivalent to five grains of the powder—every five or ten minutes, till a beneficial effect is produced. It is nauseous, but easily disguised in tea or coffee. The indications for giving it are, according to Dr. Churchill—1, feeble and inefficient pains, without especial cause; 2, if the os uteri be soft and dilatable; 3, if there be no obstacle to a natural delivery; 4, if the head or breech present, and are sufficiently advanced; and 5, if there be no head symptoms, nor excessive general irritability. But, on the other hand, it should not be given—1, if the os uteri be hard and rigid; 2, if the presentation be beyond reach; 3, if there be a malpresentation; 4, if the pelvis be deformed; 5, if there be any serious obstacle to delivery in the soft parts; and 6, if there be head symptoms, or much general irritation.

Excessive quantity of the liquor amnii is sometimes enumerated as a cause of tedious labour, and it is true that it is apt to be in excess when the patient is feeble, and the child small and ill-nourished. The remedy for this is rupture of the membranes; but it should not be practised without due caution, else it may lead to tediousness of parturition, from

Premature rupture of the membranes.—This may occur through their own weakness and tenuity, or through some accidental violence, or the officiousness of the accoucheur. The mischief which results is, that the os uteri, instead of being dilated by the soft yielding bag of waters, comes into contact at once with the child's head, which makes it much slower in dilating. Patience is the best remedy.

Toughness of the membranes.—This, the opposite to the preceding condition, is sometimes a cause of delay; but once ascertained, it admits of an easy remedy. The practitioner should cut a notch or two in his finger nail, and *saw* through the membranes with it at the most projecting spot during a pain. Whenever the membranes protrude unbroken down to the os externum, they may be ruptured without ceremony. In some few cases, the child has been expelled with the bag of membranes and placenta, *en masse.*

Rigidity of the *soft parts* is a very common and serious cause of delay in women who have children late in life, or who are of a plethoric constitution, with well-developed muscular system. The pains are violent, but the head makes no progress, either because delayed by a rigid and undilatable os uteri, or by the vagina and os externum. This state is almost sure to be followed by inflammatory symptoms, urgent excruciating pains, great tenderness, and thin acrid discharge from the vagina; and if it continues unrelieved, there will come dry brown tongue, rapid faltering pulse, and other signs of exhaustion.

Treatment.—The two indications are to *gain time*, and to *counteract inflammation:* and the means are—1st, a moderate bleeding, if the constitution can bear it; 2ndly, a good dose of opium, so as to suspend uterine action; and 3rdly, small doses of tartar emetic, which may be substituted for bleeding, if the woman cannot afford to lose blood: at the same time, *lard* should be freely introduced into the vagina, to cool and lubricate the passages. In most cases this plan will be successful, and after a few hours' rest and sleep, labour pains will return, the rigidity will vanish, and the labour terminate favourably.

Pendulous belly.—The early stage of labour in women who have borne many children, is often delayed by an extremely oblique position of the womb, *owing to relaxation* of the abdominal parietes, which

permit the uterus to fall forwards; and thus the child's head, instead of being impelled into the brim of the pelvis, is merely driven back, as it were, against the upper part of the sacrum. The remedies for this state of things are, to let the woman lie on her back, and to support and draw up the fundus uteri by means of a shawl passed round beneath the pendulous belly, and fastened behind the back.

Shortness of the umbilical cord is usually enumerated in books as one cause of retarded labour; but it is one that must be excessively rare. *Twisting of the cord* many times round the neck or body of the fœtus, is a similar hypothetical cause; and if, in any case, when the child's head is already on the verge of birth, it should be unaccountably delayed, there being plenty of room, and the cord being felt twisted round the neck, an effort may be made to loosen it, and slip a coil of it over the shoulders. If this cannot be done, and if the birth is delayed, and the child seems in danger of strangulation, the best plan will be to make a notch in the finger nail, and saw it through.

An inflammatory or rheumatic state of the uterus is sometimes met with as a cause of delay, rendering the uterine contractions extremely painful and inefficient. The patient generally says, that she has been feverish and restless, troubled with abdominal tenderness, loaded bowels, and scanty high-coloured urine for some time before parturition. The remedies are, bleeding, fomentations, an aperient of mag. sulph. and sodæ carb., and alkaline drinks.

Cicatrices of the os uteri, or vagina, or perinæum, the result of laceration or sloughing in former tedious labours, or caused by the ill use of instruments, are occasional causes of obstruction to the child's head. The rule of treatment seems to be—give the natural efforts a fair chance; arrest inflammation and cause relaxation by bleeding or tartar emetic; *gain time* by administering opiates; soothe and lubricate the parts

with lard, or cold cream; but if nothing answers, and the uterine contractions seem quite inadequate to overcome the difficulty, the obstructing part must be cautiously touched with the edge of a bistoury, whilst it is on the stretch before the child's head. *Imperforate hymen*, if it should exist to a degree sufficient to cause obstruction, may be divided without ceremony.

Carcinoma of the os uteri.—Conception has been known to take place, and the pregnancy to go to the full term, when the os uteri has been the seat of carcinoma, and even of open cancer. Incision with the knife, or diminution of the child's head, may be necessary, in order to overcome the hard, gristly, undilatable condition which this disease occasions.

Extravasation of blood into the labia, a *varicose state of the veins* of that part; and *œdematous swellings* of the labia or nymphæ, are not uncommonly met with in flabby constitutions, and act rather as disagreeable complications than as hindrances of labour. Varicose tumours, if they burst, may give rise to an alarming or fatal hæmorrhage; and as that returns with every pain, it may be necessary to use the forceps, or some other summary means of expediting labour. Extravasation into the labia is best treated by cold applications, as long as there seems any chance of the blood being absorbed; but if the swelling inflames, and threatens suppuration, it should be punctured, and a poultice be applied. Œdema of those parts is treated by warm spirituous fomentations.

Distention, or prolapsus of the bladder, in cases of lingering labour, where the state of that viscus has not been attended to properly, may be an obstacle, but one that is easily overcome by the catheter. A small elastic male catheter is the best instrument to employ.

Stone in the bladder, if it have got down in the way of the child's head at an advanced stage of labour, may be a very troublesome cause of delay, but

luckily is very rare; of course, if necessary, it must be extracted by surgical means, as if no labour were going on.

Distention of the rectum by hard fæces is usually accounted in books as one cause of obstruction to labour; but it is so, rather by the general torpor of which it is the indication and consequence, than by any mechanical effects. A good stimulating enema, or the removal of scybala with the handle of a spoon, are the remedies.

Tumours may form most serious obstacles in labour, and they may be of various kinds. If consisting of exostosis, bony or cartilaginous, the case must be treated just as if it were one of pelvic deformity; whether by the natural efforts, aided by time; or the forceps; or the diminution of the child's head; or the Cæsarian section; or by the induction of labour before the full term of gestation has been completed.

If the tumour consist of a *polypus uteri*, which fills the vagina, the best plan is to pass a tight ligature round its neck, and cut it off.

If, at the early stage of labour, the existence of a moveable tumour in the pelvis is detected, it may be in the accoucheur's power to push it up, and keep it out of the way of the child's head, till the latter has come down before it.

If the tumour consist of an enlarged ovary, or of any form of encysted tumour, and it cannot be pushed up out of the way, it may be punctured with a trocar.

If, however, it be solid and incompressible, the case must be treated as if it were one of pelvic deformity.

Deformed pelvis.—Uniform smallness of the pelvis, or contraction of its brim, or of any part of its cavity or outlet, are of course most serious obstacles to labour. Unless aid be given, not only the child will be destroyed, but the mother's vital powers will be entirely exhausted in inefficient parturient efforts; and if the child be allowed to remain impacted in the pelvis,

there will be sloughing of the soft parts, apertures from the vagina into the bladder and rectum, and other consequences, that render the patient's life a misery if she survives.

Treatment.—If the passage of the child's head is delayed through insufficient space in the pelvis, the patient may be delivered with the vectis or forceps; or where these instruments cannot be used, the Cæsarian section should be performed. Shivering, vomiting, dry brown tongue, and a pulse above 100, show a necessity for active interference.

Malpresentations of the child.—This is a frequent cause of difficult labour; but our space will not allow us to enter upon them.

Deformities of the child.—Accumulations of water in the head; tumours in the chest or abdomen; excessive size of the child; and monstrosities, such as the union of two children by the navel, like the Siamese twins, may be all obstacles to parturition, but we cannot do more than allude to them here.

BREECH PRESENTATION, OR BY THE NATES—takes place in about 1 in 60 cases, and although usually favourable as regards the mother, is fatal to the child in 1 in 3½ cases, from the pressure exercised upon the cord during delivery. But little interference is necessary, as Nature will bring about the delivery, the practitioner aiding only in the latter stages, when one or other part becomes fixed in the pelvis. Some delay occurs after the body has been expelled by the locking of the head of the child; a little assistance will generally relieve this, and complete delivery.

PRESENTATIONS OF INFERIOR EXTREMITIES—may be the knee or foot; but as the labour advances, the foot protrudes. They are next in frequency to the preceding, being 1 in 105; the mortality is greater, being 1 in ½ cases. The observations applied to the breech presentation are equally applicable to this.

PRESENTATIONS OF UPPER EXTREMITIES.—The

shoulder generally presents first, the arm becoming prolapsed subsequently. This form occurs in 1 in 231 cases; the mortality to the child is more than one half, to the mother, 1 in 9.

TWIN CASES.—The treatment adopted in these is the same as in ordinary cases. When one child has been delivered, the practitioner must wait for uterine action, and expulsion of the second, as it is dangerous to force on the labour. The second is usually born within half an hour after the first child.

Each child possesses its own placenta, and no attempt should be made to remove that of the first until the second child is born; both placentæ should then be removed together, which may be done by twisting the cords around each other.

Stimulants are necessary to support the mother, and of these opium is the best.

TRIPLETS, &c. — The preceding observations will apply to these cases.

ON HÆMORRHAGE, OR FLOODING. — *Unavoidable hæmorrhage.*—This variety arises from an implantation of the placenta over the os uteri, so that when the latter begins to dilate towards the end of pregnancy, its connexion with the placenta is torn asunder, and hæmorrhage results. This malposition of the placenta is called *placenta prævia, placental presentation, &c.* It may be implanted either entirely over the centre of the os uteri, or partially.

That which distinguishes this kind of hæmorrhage is, that it usually begins without evident cause, about a fortnight or three weeks before the end of the natural term of gestation, and that the gush of blood is *accompanied by uterine contraction.* It begins in moderate or small quantity, but recurs repeatedly, till the patient is in imminent danger of bleeding to death, unless relief be afforded by art, or unless the placenta (as sometimes happens) becomes entirely detached and expelled through the vagina before the child's

On making an examination, and tracing the os uteri, a thick, soft, spongy mass is felt, firmer than a mere clot of blood, and not breaking down under the finger. If it only partially covers the os uteri, its edge will be felt continuous with the membranes, and through the latter the presentation may perhaps be felt.

Treatment. — If the hæmorrhage is not very great, and the placenta is only attached to the edge of the os uteri, without covering any part of its area, and if pains are present, rupture the membranes; for then the pressure of the head dilating the os uteri will close the vessels, and prevent further bleedings.

If the placenta is only partially attached over the os uteri, and the *feet present*, rupture the membranes, seize the feet, and bring down the child at once.

When the hæmorrhage is severe, and the os uteri is still undilatable, the ordinary practice is, to plug the vagina firmly with pieces of old linen, and keep the patient perfectly at rest, with cold applied to the pubes; and then when the os uteri has become dilatable, to insinuate the hand between it and the placenta, perforate the membranes, seize the feet, and complete the delivery by the ordinary steps of the operation of *turning*.

Some writers recommend that the hand should be passed *through* the placenta, and not *between* it and the womb—a thing much more difficult to effect.

Since the child almost always perishes in these cases (in consequence of the detachment of the placenta), and since the mother is in great danger, from the operation of turning and from the hæmorrhage, it has been proposed by Drs. Radford and Simpson, to practise the entire detachment and extraction of the placenta: "in severe cases of unavoidable hæmorrhage, complicated with a rigid and undilated os uteri, in which turning would be either impossible or hazardous; in most primiparæ; in unavoidable hæmorrhage with *premature labour* and an undeveloped condition of the

os and cervix; in placental presentations with distorted pelvis; in cases where the extreme exhaustion of the patient forbids turning, and where the fœtus is ascertained to be dead, or is premature and not viable." But this practice has been violently opposed by other eminent accoucheurs.

Hæmorrhage before and during labour. — This, which is commonly called *accidental* hæmorrhage, depends upon the separation of some portion of the placenta, and may be caused by an inflammatory impetus of the uterine circulation, by external violence, immoderate muscular exertion, and mental excitement. This variety of hæmorrhage is distinguished from that which depends on implantation of the placenta over the cervix uteri by these circumstances: viz., that the os uteri may be felt, on examination, to have nothing in it but the membranes; and that the discharge of blood comes on during the intervals of pains, and is arrested by uterine contractions; whereas, in the unavoidable hæmorrhage, it occurs during the pains, and ceases during the interval.

When the blood which is poured forth from the uterine vessels on the separation of the placenta is at once discharged externally, the nature of the case is of course clear. But it may happen that the blood may be poured into the bag of membranes, or be retained between the membranes and the womb, without being discharged externally, and in this latter case, the hæmorrhage may proceed to a fatal extent without being suspected. This may be suspected, if, towards the end of pregnancy, the patient is subjected to any of those causes that are liable to bring on hæmorrhage, and if she complains of dull aching pains in the back, tenderness of the womb, with, perhaps, obvious swelling at some part of it, together with faintness and the constitutional signs of loss of blood.

Treatment.—If the hæmorrhage is not very profuse, and the patient not near the full term of gestation, the

case may be treated according to the rules laid down in a former page for threatened abortion ; viz., by the recumbent posture, on a hard, cool bed ; by the application of iced water to the pubes ; enemata of cold water ; and either the sulphuric acid, or the acetate of lead, with opium.

Should these measures not succeed quickly, the *tampon*, or plug for the vagina, should be introduced ; and the object of this is to fill the vagina so completely with small pieces of sponge, that there shall be no room for the escape of blood. It must be remembered that it is never of any use to employ this remedy if the uterus is empty, as after childbirth ; as then the blood might collect within its cavity till the patient's veins were quite exhausted.

If these measures fail, the only other plan of treatment is founded on the principle, that *contraction of the uterus* is the surest preventive of hæmorrhage, as the vessels which are large and gaping when the organ is relaxed, are mechanically compressed when it is contracted. In order to produce this contraction, the womb must be emptied ; in other words, labour must be brought on.

The first means for this purpose, is the *evacuation of the liquor amnii ;* which may be followed by the ergot, if uterine contraction does not come on quickly enough.

Hæmorrhage after the birth of the child.—This may arise, in the first place, from *inaction of the womb ;* from an absence, in fact, of that contraction which I have just stated to be the effectual safeguard against hæmorrhage. The uterus is felt large and flabby in the abdomen ; perhaps the placenta is retained, from an absence of this salutary uterine contraction ; perhaps it has been already expelled, and the womb relaxes afterwards.

Treatment.—In either case, get the womb to contract ; *grasp it gently*, but firmly, with the left hand

on the abdominal parietes; *dash cold water* on the abdomen, not so as to cause continued cold, but to cause *sudden shocks;* give ergot of rye with brandy; and, if nothing else will do, introduce the right hand, gently but resolutely, and compress the part of the womb from which the bleeding proceeds (which may be known by its irregular surface) between the knuckles of the right hand, and the left hand externally. In all probability, this will excite such a contraction, as will drive the right hand out through the vagina. It must be remembered, however, that the introduction of the hand requires some caution if the woman is *very weak and exhausted*; because the disturbance and slight hæmorrhage which the operation occasions might be enough to turn the scale, and decide the case fatally; therefore in any such extreme case, a good dose of brandy and ergot should be given first, and the pulse should be raised a little.

The hæmorrhage may, however, be attended with partial adhesion of the placenta (a portion of which is afterwards seen to be hard and gristly) to the uterus, and with an irregular spasmodic or *hour-glass* contraction of the latter organ. In this case, having placed the left hand on the abdomen, so as to grasp and steady the womb, introduce the right hand (compressing the fingers of it into a conical shape) gently through the contracted portion of the womb; separate the placenta, and then in all probability the uterine contractions will drive out the hand and placenta together, and the case be terminated.

Constitutional effects of hæmorrhage.—If blood be lost to a serious extent, and *the head be raised*, faintness ensues, and the bleeding stops; but if the head be kept low, so as to favour the flow of blood to the brain, the bleeding may continue almost to death without faintness, but convulsions ensue instead; in either case, if the patient complains of dimness of sight and noises in the ears; if there is *frequent sighing*, and

tossing of the arms out of bed, and intolerable restlessness, there is great danger.

Treatment.—Beef or chicken tea, and brandy, with small doses of opium, must be administered; and if no other means answer, blood must be taken from some healthy bystander, and be poured gently into the patient's veins.

PUERPERAL CONVULSIONS consist of violent and repeated epileptic paroxysms, attended with intense congestion of the brain, and insensibility; and are fatal in almost one-fourth of the number of cases.

The *causes* are, generally, a loaded state of the bowels, and scanty condition of the urine, with any circumstances favouring plethora and congestion. *Primiparæ* are more often attacked than multiparæ.

Premonitory symptoms.—Puffiness of the face and extremities, scanty urine, giddiness, and noise in the ears, often precede the actual attack.

Symptoms.—They are those of a most aggravated epileptic attack; turgid purple state of the face, convulsions of the face and of the whole body; foaming at the mouth: the tongue often dreadfully bitten; respiration laborious. This fit lasts for a time, varying from five minutes to half an hour, and then gradually subsides; the pulse becoming calm and the patient conscious; but it is almost sure to return with increased violence; and then between the fits the condition of the patient in slighter cases may be that of great weakness and confusion merely, or she may be profoundly comatose, and the more profound the coma, the greater of course the danger: for profound coma is apt to be followed by death.

Puerperal convulsions may come on either before labour, during labour, or after delivery. When they occur before labour, uterine contraction is apt to come on synchronous with the fits, and the child is generally born dead. When they come on during labour, *the latter runs nearly* its natural course, but the fits

are also synchronous with the pains, and the latter are generally of a very excruciating character. When they occur after labour, they are generally to be attributed to the injury the nervous system has received.

Treatment. — The first indication is to guard the brain from the effects of accumulation of blood; and therefore a vein should be opened, and cupping be performed afterwards on the nape of the neck, until the pulse is lower and softer, and the pupils quite sensible. There is very great tolerance of blood-letting in this disease. The head also should be shaved, and a bladder of iced water be applied to it.

The second indication is to produce a copious discharge of the urinary and alvine secretions. No remedy for this purpose is to be compared, for speediness and efficacy (not to mention its beneficial effects on the pulse), to tartar emetic, given in solution, in half-grain doses, every half-hour, till vomiting or purging occur; but it would be well to give a good stimulating enema at the very first, and also to give quite early a dose of calomel and scammony. The bladder should be emptied if requisite.

The *use of opium* is a thing which there has been much controversy about. We may say, that if given when the patient ought to be bled, it can only hasten a fatal result. But if the fits continue, especially after delivery, with signs of great irritability and exhaustion, it then may be right to give it in moderate doses.

Should the process of labour be interfered with? Not unless it can be done with perfect ease, and the passages are quite dilated. But for further information on this important point, the student may consult the works of Drs. Churchill and Rigby, quoted before.

PUERPERAL MANIA.—Women shortly after their confinement are liable to attacks of mental aberration,

and the causes are usually either gastric irritation, or else exhaustion, produced by mental excitement, hæmorrhage, or prolonged lactation.

The symptoms are usually excessive and incoherent talking; restlessness; entire want of sleep; loss of appetite; and morbid fancies of a gloomy or desponding character.

Treatment.—However excited the patient may be, venesection is not the remedy; and I must caution the student against mistaking cases of *convulsions attended with phrenitic excitement*, for the real puerperal mania; since, in the one case bleeding is necessary, and in the other injurious.

The first point must be to attend to the secretions and excretions; the tongue will often be excessively loaded and foul, and then an emetic may be of use; in all cases a persevering course of mild aperients is advisable. The child should be taken away; and the best plan then is to remove the patient from home to some quiet country situation, where with pure air, nutritious unstimulating food, and good nursing, she will probably recover her mental powers in the course of a few months.

PUERPERAL FEVER.—This awful malady, which has received several names at different times, deduced from its more prominent symptoms, such as *puerperal peritonitis*, &c., is in reality, as has been mainly proved by the researches of Dr. Ferguson, a *blood disease*, and therefore, although usually complicated with local inflammation, is in all respects a *true fever*.

There are four principal varieties of it.

First, the most common variety, which is characterized by pain and tenderness in the abdomen, preceded by shivering. This is often brought on, apparently, at first, by the action of an over-dose of aperient medicine. If treated by Dover's powder, and a large bran poultice to the abdomen, it may probably

subside; should it persist, it must be treated by leechings or bleedings, calomel and opium, and other remedies for peritoneal inflammation.

Secondly, there is a form which assumes the character of a mild typhus, accompanied by intestinal irritation. It is ushered in by rigors, followed by a hot fit, and succeeded by vomiting, nausea, or diarrhœa, with most offensive and unhealthy evacuations. "The tongue," says Dr. Ferguson, "at first loaded and white, soon becomes preternaturally red; as in those affected by chronic dysentery. The skin is dry, hot, and of a dusky yellow hue; the mind is unsettled, without being absolutely delirious; the debility is extreme, and the limbs tremulous. In some cases these symptoms are followed by acute inflammation of some important organ, or of the joints, softening of the womb, suppuration of its lymphatics, or veins, &c." This form is best treated by copious enemata of warm water, and castor oil by the mouth, so as to empty the bowels completely; venesection, or leeches, according to the strength; small doses of grey powder, and Dover's powder; fomentations to the abdomen, and mild nutriment; astringent medicines and anodyne injections, should there be a chance of exhaustion from diarrhœa.

Thirdly.—There is a form of puerperal fever in which the main mischief seems to be expended on the nervous system; great delirium, agitation, and sense of impending death; liable to be followed by fatal coma and syncope. This variety may supervene on either of the others. The treatment of this form chiefly consists in soothing measures.

Fourthly.—There is a form of puerperal fever, and the worst, in which the most extensive evidences are afforded of the action of a poison diffused through the blood over the frame, and which presents the most perfect analogy with scarlatina maligna. Shivering and abdominal pain are followed by rapid exhaustion,

quick pulse, glassy eye, and dusky skin. There are often pain in the chest, husky cough, laborious breathing, and other signs of inflammation of the lungs, which after death may be found gangrenous. The pleuræ are often found filled with liquid. Abscesses in the joints and cellular tissue (the latter being of the nature of phlegmonous erysipelas, or diffuse cellular inflammation), phlebitis, gangrene of the intestines; suppuration of the eyes—these are amongst the ravages of this most fatal malady. Treatment is almost hopeless, but the indications are to support the strength and relieve symptoms.

Pathology.—Some authors have attempted to explain the diversity of symptoms in the various forms of puerperal fever, by supposing them to depend on a variety of local inflammations. For instance, that an active inflammatory form of fever arises from inflammation of the peritonæum, a low typhoid fever, from inflammation of the uterine veins, or lymphatics, &c. But this is evidently confounding collateral effects with causes.

Recent researches have shown that puerperal fever may be excited, if almost any form of putrefying animal matter be brought into contact with women in the puerperal state, whether they imbibe it through the medium of respiration, or whether it be introduced through the vagina. Hence if a woman be confined in the same room or ward with others who have the complaint, she is almost sure to be seized with it. And if the practitioner has been attending one female with it, he will be sure, if he attends others, to carry it to them likewise. Moreover, if he has been *performing a post-mortem examination, or dressing any wound attended with putrid discharge,* he will be nearly sure to convey infection likewise; and there is a disease more likely to give rise to puerperal fever than erysipelas. In fact, between these two diseases *there is a well-known* relationship; when the mother

dies of the one, in hospitals, the child often perishes of the other; and the production of fatal erysipelas, from wounds made during the dissection of puerperal women, is a matter of painful notoriety to every member of the medical profession. Prudence and humanity, therefore, alike require that the medical practitioner should avoid being the bearer of this horrible contagion to his patients' bedside.

PART VIII.

FORENSIC MEDICINE AND TOXICOLOGY.

TOXICOLOGY is that science which treats of the Nature, Action, Antidotes, and Tests of Poisons.

A poison may be defined to be a substance, which, if administered or applied in a certain dose, is capable of destroying life. There are few poisons that are not serviceable as medicines in very small doses; and there are few, even of the most innocent medicines, which will not destroy life if given in sufficiently large doses. Common salt and sulphate of magnesia are examples.

Poisons may be arranged under three grand classes —viz., IRRITANTS, NARCOTICS, and NARCOTICO-ACIDS.

Generally speaking, a person may be supposed to e poisoned if, being in perfect health, he is attacked, ter having taken some food or drink, with violent in, cramp in the stomach, vomiting, convulsive tions, and a sense of suffocation; or if he be seized, der similar circumstances, with vertigo, delirium, unusual drowsiness.

All these symptoms may, however, be the result of den illness; it will therefore be necessary to use h discrimination in such cases.

IRRITANT POISONS are divided by Dr. Christison five orders, as follow:—the Acids, and their ; the Alkalies, and their salts; the Metallic *ounds; the* Vegetable and Animal Irritants;

and the Mechanical Irritants. To these Dr. Beck adds the Acrid Gases.

Under the *first order* are classified Sulphuric Acid, Nitric Acid, Hydrochloric Acid, Acetic Acid, Oxalic Acid, Phosphorus, Iodine, Iodide of Potassium, Bromine, Bromide of Potassium.

Under the *second order* are classified—Potash, Carbonate of Potash, Nitrate of Potash, Soda, Ammonia, Hydrochlorate of Ammonia, Lime, Chloride of Lime, Liver of Sulphur, Sulphuret of Soda.

Under the *third order* are classified—Arsenic, Antimony, Lead, &c.

Under the *fourth*—Gamboge, Colocynth, Euphorbium, Cantharides, &c.

Under the *fifth*—Glass, Sponge, Pins, &c.; but these can hardly be called poisons.

Among the Acrid Gases—Nitrous Acid, Chlorine, Ammonia, &c.

THE GENERAL SYMPTOMS OF IRRITANT POISONS ARE—Immediately, or in a very brief interval after the poison has been taken, the patient complains of burning pain about the fauces and œsophagus, and constriction; excessive pain in the stomach and intestines, with a desire to vomit; great thirst; copious vomiting and purging, with tenesmus; a sense of constriction across the chest and difficulty of breathing; pain in the region of the kidneys, followed by strangury; convulsions; cramps in the extremities; tremulous and almost inaudible voice; faintings; cold sweats; and a small, quick, and constricted pulse. With these symptoms there may be also, either *hæmatemesis*, *hæmaturia*, or *melæna*. The intellectual faculties remain perfect, until the fatal termination is near at hand.

General treatment of irritant poisoning.—First, get rid of the poison by vomiting, giving large draughts of gruel or thick gummy fluids; secondly, give, at the same time, the proper chemical antidote, if any is

nown; *thirdly,* combat subsequent inflammation; *ourthly,* allay the nervous irritation which always ollows.

POISONING BY ACIDS.—These produce the general ymptoms of irritant poisoning, together with more han ordinary injury of the mouth and fauces. The ps and fauces are charred and rendered *black* by sul- huric, *yellow* by nitric, and *white* by muriatic acid.

Treatment.—Calcined magnesia with water, or if his cannot be had, chalk and water, soap and water, r lime from a whitewashed wall, beaten down and ixed with water, should be given. Afterwards, ruel and milk.

The *alkaline* carbonates, being themselves poisons n large doses, should not be given.

Oxalic Acid.—The treatment is the same as above; ut the student must bear in mind that *every soluble xalate* (oxalate of potass, salt of lemons, &c.) is oisonous, and that this acid, besides its action on the tomach, has a remote action on the heart and ner- ous system, which is equally deadly; consequently, hat it must be removed from the stomach as soon as ossible, and this is best accomplished by the stomach ump.

PHOSPHORUS.—An emetic should be given to re- ove the poison from the system, and copious draughts f liquid, containing magnesia suspended, should be dministered. The magnesia neutralizes any acid roduced by the phosphorus. Oil should be avoided, s phosphorus is soluble in it.

IODINE.—Emetics, to remove the poison. Any in- lammation must be combated by proper means.

ALKALIES, ALKALINE SALTS, LIME. —*Pure Po- ash, or its Carbonate, Soda, and Ammonia.*—Vinegar nd lemon juice are the antidotes. Large quantities of ils, which act by forming soaps, have been recom- ended.

POTASSII SULPHURETUM.—Emetics, followed by

chloride of soda, to decompose the hydrosulphuric acid which is evolved, and which seems to be the cause of death.

NITRATE OF POTASS.—Emetics, and mucilaginous drinks, with opium.

THE METALLIC COMPOUNDS — *Arsenicum, and its Compounds.* — All the chemical compounds of this metal are highly poisonous; those which are met with in the arts are the following:—

1. The Protoxide of Berzelius, or Fly-powder. 2. The Arsenious Acid, or *White Arsenic.* 3. The Arsenite of Copper, or *Mineral Green.* 4. The Arsenite of Potash, as contained in *Fowler's Solution.* 5. The Arseniate of Potash; and 6. The various Sulphurets, pure and impure—namely, *Realgar*, *Orpiment*, and *King's Yellow.*

Symptoms.—The symptoms of poisoning by arsenical compounds may be considered under three heads:—1. When the patient dies between twenty-four hours and two or three days. 2. When he expires in five, six, or ten hours, or, at furthest, within the first day. 3. Where life is prolonged six, eight, or ten days, or is saved altogether, but after some illness.

The first case, where the patient dies between twenty-four hours and two or three days, is the most common of all. The symptoms in this case are—sickness or faintness, which is succeeded by a burning pain in the stomach, violent vomiting, epigastric tenderness, cramp, heat and tightness in the throat, with a constant desire for drinks. The matter vomited is greenish or yellowish, and is frequently streaked with blood. Pain is also felt along the course of the alimentary canal, and there is frequent diarrhœa, with tenesmus. The mouth and lips occasionally present dark specks or vesications. The viscera of the chest sometimes become inflamed. The genital organs, both in the male and female, become swollen and painful, and there is frequent painful and difficult micturition.

When the gastro-enteric symptoms have subsided for some hours, convulsive tremors of the limbs and body come on; the pulse is quick and feeble; the skin cold and clammy; and the feet and hands are livid. There is great anxiety depicted in the countenance; the eyes are red and sparkling; the tongue and mouth are parched; and sometimes small ulcers appear on the velum and fauces. Death, in general, comes on calmly, but it is sometimes preceded by delirium and convulsions.

The second variety.—In this variety death seems to ensue from the *shock to the nervous system*, caused by the introduction of a large dose of the poison. Vomiting sometimes occurs at the usual period after taking the poison, but it seldom continues. The most uniform effect is, extreme faintness, amounting at times to deliquium. Sometimes there is stupor, or rather oppression, and often convulsions.

In the third case, the early symptoms are the same as in the first variety, but the succeeding ones are referrible to nervous irritation. These latter symptoms come on as the former recede. They vary, in different individuals, from coma to an imperfect paralysis of the arms and legs, and between those extremes are observed epileptic fits, or tetanus.

Treatment.—Every supposed antidote to this poison will prove useless if it do not render the arsenic insoluble, not only in water, but also in the gastric fluids. *Sulphuret of potassium* was for a long time regarded as an antidote; but the researches of Renault and Orfila have proved that the arsenical sulphuret thus formed is nearly as dangerous as arsenious acid itself. *Magnesia* and *charcoal*, in powder, have been proposed as antidotes; but they are quite inert. The *hydrated peroxide of iron* (which may be readily formed by adding liq. ammoniæ to the tinct. ferri sesquichloridi) is the best antidote, but the safest plan is to get rid of *the poison at once* by means of the stomach pump.

Should this be not at hand, an emetic of sulphate of zinc should be administered; and milk or gruel, containing some of the hydrated peroxide of iron, should be drunk, both before and after vomiting has begun, for the purpose of enveloping the powder, and procuring its discharge. After the poison has been removed from the stomach, two indications of cure remain to be fulfilled—viz., to allay the inflammation of the alimentary canal, and to support the system under the great depression which supervenes in most cases. The first indication must be fulfilled by antiphlogistic treatment; but blood-letting should not be had recourse to until all the poison has been removed from the stomach, as it promotes absorption, by causing emptiness in the vessels. Oily enemata and fomentations to the abdomen will be found useful. When the poison has been entirely removed, and the inflammation subdued by blood-letting, opium, in small doses, will be found advantageous. Poisoning by arsenic may be accomplished by the constant use of it in small quantities; the symptoms in this are, irritability of the stomach and bowels, wasting of the body, itching about the eyes and eyelids, falling off of the hair, and a peculiar blanched condition of the skin. As this poison tends to accumulate in the system, its medical use should not be continued for any length of time.

MERCURY—*Corrosive Sublimate.*—In ordinary cases, the symptoms of poisoning by this mineral are—an acrid, astringent, metallic taste in the mouth; a sensation of stricture and burning heat in the throat; anxiety; and rending pain in the stomach and bowels; nausea; frequent vomiting of a fluid which is sometimes bloody, and accompanied by violent efforts; diarrhœa; sometimes dysentery; pulse small, constricted, and frequent; faintness; general debility; dyspnœa; cold sweats; cramps in the limbs; insensibility; convulsions; death.

As discriminative of the effects of this substance from those of arsenic, Dr. Christison observes, "that its symptoms begin much sooner, the irritation in the throat sometimes commencing during the act of swallowing, or the first five minutes afterwards; that its taste is more equivocal and strong; that the sense of acridity in the throat and stomach is much more severe; and that the countenance is usually flushed and swollen." In addition to these, it has been noticed that there is great diminution in the secretion of urine. According to Dr. Christison, the ordinary duration of fatal cases is from twenty-four to thirty-six hours.

Treatment.—When a poisonous dose of corrosive sublimate has been taken, we possess some effectual antidotes. Orfila has shown that *albumen* is an effectual antidote to corrosive sublimate, which it converts into protochloride of mercury and chloride of albumen. White of egg is a good and convenient form of albumen; and, according to Peschier, the white of *one egg* is required to render *four grains* of the poison innocuous. The *gluten of wheat* is also a good antidote; and when neither albumen nor wheaten flour is at hand, *milk* is a convenient substitute. MM. Mylne-Edwards and Dumas have shown that *iron filings* are also a good antidote. The mode in which they act is obviously by reducing the mercury to the metallic state. *Meconic acid* is a powerful antidote to this poison.

The treatment of the mercurial salivation which ensues, consists in exposing the patient to a cool air, the use of a nutritious diet, mild saline purges, full doses of sulphur at night, and chloride of soda gargles. Blood-letting is required in some of the inflammatory affections it induces; in others, it is injurious.

ANTIMONY — *Tartar Emetic.*—The symptoms produced by a poisonous dose of this substance are—a *rough metallic taste*, nausea, copious vomitings, burn-

ing heat in the epigastrium, colic, copious stools, syncope, small and quick pulse and cold skin; occasionally dyspnœa, vertigo, convulsions, cramps in the legs, prostration of strength, and death. The vomitings and alvine excretions do not always take place, and the consequence is, an aggravation of all the other symptoms.

Treatment.—Vomiting, if not already present, should be excited by tickling the throat, and the administration of tepid water, with *decoction or tincture of cinchona.* One ounce of the decoction of yellow cinchona bark will decompose, and render inert, a scruple of tartar emetic. All vegetable substances that contain a considerable proportion of tannin also decompose this salt; such as catechu, green tea, uva ursi, &c.

When the SALTS OF COPPER have been taken, many of the symptoms above detailed are present; in addition to which, there is a coppery taste in the mouth, and constant colic and vomiting.

Antidotes.—The best antidotes are, *albumen*, and the *ferrocyanide of potassium. Metallic iron* is also a good antidote. *Sugar* was formerly supposed to be a good antidote, but the experiments of Orfila completely disprove that opinion. *Vinegar* should never be given, as it renders the copper more soluble; but the best rule is, to get rid of the poison by vomiting. Should any gastro-enteric symptoms remain after the poison has been evacuated, they should be treated on the ordinary principles. Opium and antispasmodics may be indicated for the spasmodic affections that are apt to remain.

When SULPHATE OF ZINC is taken in a poisonous dose, it generally acts as a powerful emetic; and this action should be promoted by giving warm and emollient drinks. *Milk* is particularly indicated, from its power of decomposing the poison. *Albumen* is also capable of acting on sulphate of zinc. The accession of inflammatory symptoms must be carefully watched,

and combated early; any irritation must be relieved by anodynes.

The treatment of poisoning by NITRATE OF SILVER consists in the administration of the *chloride of sodium*, the chlorine of which combines with the silver, forming an insoluble and inert chloride, mucilaginous drinks and emetics. Should any signs of irritation ensue, they may be subdued by opium.

The treatment of poisoning by the TRISNITRATE OF BISMUTH consists in giving *milk* and mucilaginous drinks; and if symptoms of inflammation supervene, the antiphlogistic regimen will be required.

For the irritant form of poisoning by the *preparations of* LEAD, the *sulphates of soda and magnesia* form effectual antidotes. They decompose the acetate in particular, and change it into an insoluble sulphate of lead, which Orfila considers inert. The *phosphate of soda* is also an antidote. Diluents and purgatives should be given; and any inflammatory tendency should be subdued by the antiphlogistic regimen.

The treatment of *colica pictonum* and *paralysis* from lead, will be found in another part of this work.

When the SALTS OF BARYTA have been taken, *sulphates of soda or magnesia* are the proper remedies, when used early. These decompose the poison, and form an insoluble sulphate of barytes. Vomiting should be encouraged.

In almost all cases of recent poisoning, the use of the stomach-pump should be immediately had recourse to, before the poison has had time to act upon the mucous membranes.

VEGETABLE AND ANIMAL IRRITANTS.—Bryony, Elaterium, Colocynth, Euphorbium, Castor-oil Seeds, Croton Seeds, Stavesacre, Mezereon, Jalap, Scammony, Gamboge, Savine, Indian Tobacco (*lobelia inflata*), and Elder.

The symptoms produced by vegetable irritants are *milder than those* caused by corrosive poisons. As it

would be impossible, in the confined limits of this work, to detail the symptoms produced by each poison, I shall give those which are generally present in such cases. These are—vomiting and purging, pain in the stomach and bowels, quick respiration, vertigo, syncope, weak and labouring pulse, cold sweats, and convulsions.

Treatment.—Emetics should be given, and castor-oil and mucilaginous injections, to pass the poison rapidly through the intestines and soothe them.—Afterwards chalk mixture and opium. Any inflammation or irritation in the alimentary canal must be combated by the usual means. The great prostration of the powers of the system which is present in some of these cases renders them extremely dangerous.

ANIMAL IRRITANTS.—Cantharides, poisonous Serpents, poisonous Fishes, &c.

CANTHARIDES.—*Symptoms.*—When taken internally, *cantharides* excite a disagreeable and nauseating smell, acrid taste, retchings, copious vomitings, alvine evacuations, burning heat in the stomach; discharge of blood, both by vomiting and purging, with griping pains in the bowels; great heat in the bladder, difficulty in voiding the urine, which is often bloody, but sometimes suppressed; obstinate, and sometimes painful priapism; frequent and hard pulse. Convulsions, delirium, and general rigidity of the limbs, precede the death of the patient. Sometimes there is no affection of the urinary organs.

Treatment.—Mucilaginous drinks, to excite vomiting and diminish irritation in the bladder; a mild aperient, and opiates. The warm bath, friction, and diluents, are proper. Inflammatory symptoms must be combated by antiphlogistic measures. Oil is contra-indicated, as it dissolves the active matter of the cantharides.

POISONOUS SERPENTS.—The Viper (*Coluber berus, Vipera berus*), and the Rattlesnake (*Crotallus horridus and durissus*), Cobra di Capello, &c.

Symptoms.—Acute pain in the wounded parts, which extends over the limb; tumefaction and redness, which afterwards change to a livid colour; frequent, small, and irregular pulse; syncope, difficulty of breathing, copious and cold sweats, bilious and convulsive vomitings, followed by jaundice, delirium, and imperfect vision, gangrene and death. The bite of the viper is more dangerous in summer than at any other period.

Treatment.—The use of the *cupping glasses*, and the application of ligatures above the part bitten, but not too tight, nor too long continued. The wound should then be cauterized with nitrate of silver, and afterwards hot fomentations applied to the part. Excision of the bitten part has also been strongly recommended. Sleep and perspiration should be encouraged by large doses of ammonia, wine, ether, and opium; and the patient should be kept warm in bed. Arsenical preparations are said to act powerfully in counteracting the effects of the bites of snakes.

POISONOUS FISH. — The symptoms produced by *mussels*, the most common poisonous fish in this country, are excessive oppression and pain, swelling of the face, a scarlet efflorescence over the body, thirst, tormina, and vomiting. In fatal cases, coldness of the extremities, low and quick pulse, hiccup, delirium, and occasionally coma, supervene.

Treatment.—If neither vomiting nor purging is present, emetics and purgatives should be given, according to circumstances; stimuli and anodynes are afterwards to be administered, as the symptoms may require.

MECHANICAL IRRITANTS. — *Glass and Enamel in Powder.*—This substance was formerly supposed to possess corrosive properties, but it has been proved by the *best authorities* that it is merely a mechanical

irritant, and that its poisonous qualities depend on the irritation and inflammation which it produces.

POISONOUS GASES. — *Chlorine* produces excessive irritation of the bronchiæ; and even when diluted with atmospheric air, it excites cough and inflammation. *Concentrated Solution of Chlorine*, when introduced into the stomach, causes the ordinary symptoms of irritant poisoning. On dissection, the mucous membrane of the stomach is inflamed.

Treatment.—Give pure air; let the vapour of poppy decoction be inhaled. When inflammation comes on, it requires the usual treatment.

NARCOTIC POISONS.—OPIUM, *Symptoms of poisoning by.*—When opium or laudanum is administered at once in a large quantity, the symptoms begin with vertigo and stupor, without any previous stimulus. The stupor rapidly increases, and the person becomes insensible; the respiration is nearly inaudible, and the pulse is either small and feeble or slow and full. The patient generally lies still, with the eyes shut and the pupils *contracted*; the whole expression of the countenance is that of deep and perfect repose. As the effects increase, the features become ghastly, the pulse feeble and imperceptible, the muscles excessively relaxed, the pupils insensible to light, and the breathing occasionally stertorous. Vomiting sometimes supervenes, and reaction seems about to take place; but the comatose state soon returns, and death, which is sometimes preceded by convulsions, rapidly follows.

If opium be taken in the liquid form, it begins to act in about ten or fifteen minutes; but if in the solid form, it does not show its effects before half an hour, or even almost a whole hour. In one case, where eight ounces of crude opium (the largest quantity ever taken) was swallowed, the physician found the patient, in an hour after, able to tell connectedly all she had done; she recovered.

The ordinary duration of a fatal case is from seven to twelve hours. Most people recover who outlive twelve hours; yet fatal cases of longer duration are on record. The longest duration of a fatal case has been three days; the shortest, three hours. The smallest quantity of opium that has been known to produce poisoning in the adult is four grains and a half. Children are very easily affected by this poison. One minim and a half of laudanum have killed a child two days old.

The action of morphia is nearly the same as that of opium, but more energetic. In its solid state it has little effect, being nearly insoluble; but when dissolved in olive oil, or in alcohol, or in the acids, especially the acetic, it excites in animals the same symptoms as opium.

Narcotine is said to act as a powerful narcotic, producing contraction of the pupils, vertigo, nausea on motion, and staggering in the gait. In two persons, vomiting was induced. The doses varied from two to four grains. According to Dr. Wibmer, of Munich, narcotine is but a feeble poison. Hydrochloric acid seems to destroy the activity of narcotine altogether.

Meconine is said to be acrid.

Meconic acid is inert.

Codeine, from the experiments of Kunkel on animals, produces tetanic convulsions, excitement of the pulse and death.

Paverine is soluble in water, and saturates the acids. It is poisonous, and is said to act powerfully on the spinal marrow.

Poisoning by opium may be mistaken for *apoplexy, epilepsy, drunkenness, encephalitis, hypertrophy of the brain* and *inflammation of the spinal cord.*

Diagnosis between poisoning by Opium and Apoplexy:—1st. Apoplexy is occasionally preceded by premonitory symptoms; poisoning of course is not, except by fortuitous combination.

2nd. Apoplexy generally attacks those advanced in

life; whilst, on the other hand, poisoning by narcotics, when taken intentionally, occurs mostly among the young, and chiefly the female sex. Apoplexy, however, is not confined to old persons, for, of sixty-three cases noted by M. Rochoux, sixty-one were above thirty years of age, two less than thirty; none under twenty.

3rd. Apoplexy is said to occur in fat persons: this again is no direct criterion, for in the cases above alluded to, thirty were of an ordinary habit, twenty-three were of a thin, meagre habit, and only ten were large, plethoric, and fat.

4th. When a meal has been the exciting cause of apoplexy, the symptoms are said to begin *immediately* after, or even during, the meal. This never occurs in poisoning by opium, for an interval of 10, 15, 20, or 30 minutes always occurs.

5th. The symptoms of narcotic poisoning progress gradually. The sopor is at first slight, and becomes gradually deeper. In apoplexy it often becomes deep at once. Apoplexy does not, however, always commence with deep sopor; it being occasionally slight at first, and increasing like that of narcotism.

6th. When the sopor of apoplexy is fully formed, it is rarely possible to rouse the patient to consciousness. On the contrary, in poisoning by opium, the patient may be roused from the deepest lethargy.

7th. In poisoning by opium, convulsions are rare; in apoplexy, they are frequently present.

8th. The pupil is generally dilated in apoplexy; in poisoning by opium, it is most frequently contracted.

9th. A bloated and livid state of countenance is more common in apoplexy than in narcotic poisoning.

10th. Few people die of pure narcotic poisoning who outlive a day; apoplexy very often lasts three or more days before death, or recovery of consciousness. Again, the narcotics rarely prove so rapidly fatal as apoplexy occasionally does, as this affection

may produce death in less than an hour. The only narcotics in common use that can prove fatal so rapidly are, the narcotic gases and the hydrocyanic acid.

Distinction between Epilepsy and poisoning by Opium.—1st. The epileptic fit *is sometimes preceded by certain warnings*, such as slight stupor, a sense of coldness, or creeping; or a gentle breeze (the *aura epileptica*), proceeding from some part of the body towards the head.

2nd. The symptoms of the epileptic fit *almost always begin abruptly and with much violence.*

3rd. As in apoplexy, the person *in general cannot be roused by external stimuli.*

4th. When a person dies in a fit of epilepsy, the paroxysm generally lasts long, sometimes more than a day. Dr. Christison relates a case, however, which, after many previous fits, proved fatal in little more than an hour.

5th. M. Esquirol says that epilepsy *very rarely causes death in the first paroxysm.* Dr. Christison asserts, that it may be said the *first paroxysm never proves fatal.*

Distinction between poisoning by Opium and Drunkenness :—

1st. The history of the case, whether the person had been habituated to the use of spirits, and when any had been taken last. 2nd. The peculiar smell of the breath. 3rd. In drunkenness, the pupils are dilated; in poisoning by opium, contracted. 4th. Muscular power is in a great measure retained in drunkenness, whilst it is nearly totally lost in poisoning by opium. 5th. Delirium, and various mental affections, varying with individual character, are present in drunkenness, but are extremely rare in poisoning by opium.

The instances in which the other cases assume so doubtful a form as to be confounded with poisoning *are very rare; it* will not, therefore, be requisite to

notice them in a work which is not exclusively devoted to toxicology.

Treatment of poisoning by Opium.—The first indication is to remove the poison from the stomach; and this may be accomplished in one of four ways: by emetics administered in the usual way, by the stomach-pump, by the injection of emetics into the veins, or by injection of them into the rectum.

The best emetic is *sulphate of zinc*, in the dose of ℥ss. or ʒij., which should be repeated after a short interval, if the first dose does not act. *Sulphate of copper*, in a dose of from 10 to 15 grains, may be given. It is, however, by no means so safe or so certain an emetic as the sulphate of zinc. The fauces should be irritated by a feather, which promotes vomiting, through what is called reflex action.

The stomach-pump should be used before emetics are had recourse to. In very rare and extreme cases, where no stomach-pump can be had, it may be allowable to inject a solution of tartar emetic into the rectum or veins. When the poison has been quite removed from the stomach, as shown by the rejected fluids no longer smelling of opium, then a basin of strong coffee or green tea, mixed with vinegar, should be either swallowed, or injected with the stomach-pump. *The patient must be kept awake*, by beating the soles of the feet, dashing cold water on the face and breast, and mustard poultices to the calves; but should not be moved about too much, so as to increase the quantity of blood sent to the lungs whilst they are very imperfectly performing their functions. Ammonia may be held to the nostrils for short intervals. If the pulse flags, give beef-tea and brandy.

In extreme cases, *artificial respiration* should be had recourse to. *Venesection* has been successfully used by some practitioners. Since the researches of Magendie on absorption, it has been laid down as a rule, that bleeding should not be attempted until

the poison is removed from the system, and there is usually so much debility as to forbid it.

HYOSCYAMUS, *Symptoms of poisoning by.*—Loss of speech, dilatation of the pupils, coma, delirium, generally of the unmanageable, and sometimes of the furious kind. In some cases, there is trismus, difficult breathing, coldness and paralysis of the limbs, and in a few instances typhomania.

Treatment.—Emetics and purgatives, followed by the cautious use of stimulants. In cases which have recovered, the persons fancied all objects to be of a scarlet colour for some days after.

The *Lactuca Virosa*, and *L. Satira Solanum Dulcamara*, act as narcotics, but with much less energy than either opium or henbane. The chief indications to be fulfilled, when any of these poisons have been taken in is, to remove them as rapidly as possible from the system.

HYDROCYANIC ACID.—This acid, in its concentrated state, is one of the most energetic poisons, and its virulence varies with its strength. This acid is contained in several natural productions, such as from the leaves, bark, and fruit-kernels of certain plants; it is also prepared artificially as the result of chemical processes. It is found in considerable quantity in the Essential Oils and Distilled Waters of the Bitter Almond (*Amygdalus communis*), the Peach Blossom (*Amygdalus Persica*), the Cherry Laurel (*Prunus lauro-cerasus*), the Cluster Cherry (*Prunus padus*), and the Mountain Ash (*sorbus aucuparia*).

In smaller proportions, it is found in the *Prunus avium*, or black cherry; the *Prunus institia*, or bullace; the *Prunus spinosa*, or sloe; the *Amygdalus nana*, or dwarf-almond; and in the leaves and kernels of the *Prunus cerasus*, or common cherry. It is even contained, in very minute quantity, in the seeds of the Pomaceæ, such as the seeds of the apple and pear.

Symptoms of poisoning by Hydrocyanic Acid.—As

an example of its effects, a case recorded by Hufeland is perhaps the best. A man about to be taken up as a thief swallowed an ounce of alcoholized acid at 2 P.M. He staggered a few steps, fell with a groan, and seemed lifeless. A physician, who saw him instantly, found the pulse imperceptible, and the breathing suspended. In a few minutes, a single and violent inspiration was made; the legs and arms then became cold, the eyes prominent, glistening, and quite insensible, and after one or two more convulsive respirations, he died, five minutes after the poison had been taken.

Dr. B., of Rennes, took two teaspoonfuls of the acid (prepared by Vauquelin's process). In a few seconds, he fell; his teeth were closed; the respiration was difficult, noisy, and rattling; the mouth distorted; the extremities cold, the pulse scarcely perceptible; the face and neck red and swollen; and the pupils dilated. In fact, all the symptoms of apoplexy were present. Antidotes were administered, and after some time there was slight vomiting: but he did not recover his senses until nearly three hours had elapsed. Dyspnœa continued, but with enemas and other applications he gradually recovered. After every evacuation from the bowels, a quantity of gas was discharged from the mouth, which had the odour of hydrocyanic acid. It was a fortnight before convalescence was complete. In addition to the symptoms enumerated in these cases, this acid produces violent tetanic spasms. This acid causes, therefore, two sets of symptoms—insensibility, either with tetanic spasms, or with paralysis.

Of all the forms in which this acid may be exhibited, that of vapour appears the most instantaneous in its operation. It is poisonous in all its chemical combinations. According to Hufeland, cyanous and cyanic acids are not poisonous; but cyanogen is a *powerful poison*. The acid of the Pharmacopœia contains about 2 gr. of real acid in 100 gr.; Scheele's acid contains 5.

A person has died from the effects of 49 minims of the P. L. acid; and has recovered from 36 drops. Vide *Lancet* for 17th May, 1845.*

Treatment—The treatment consists in the use of cold affusion, especially along the spinal region, and the inhalation of diluted ammonia or chlorine. Artificial respiration should also be had recourse to, if the breathing seems likely to cease, and venesection is indicated by the signs of congestion. A mixture of protoxyde and peroxyde of iron has been also proposed, in order to form Prussian blue.

Poisoning by hydrocyanic acid may be mistaken for organic diseases of the heart, or for the *Syncopal Asphyxia* of the late M. Chevalier. This latter affection causes death with such rapidity, and its signs in the dead body are so obscure, that it may cause much embarrassment in questions regarding narcotic poisoning. It chiefly attacks women in the latter stages of pregnancy, or immediately after delivery: it has also been noticed in the male sex. A person in a state of perfect health suddenly complains of slight sickness, vertigo, and excessive faintness, immediately seems to sleep or swoon, and expires without a struggle. The only appearance of note found in the body is unusual flaccidity and emptiness of the heart. But even this appearance is not constant, for in the case related by *Rochoux*, the auricles were gorged with blood. This affection may prove fatal in the first syncopal fit, or after an hour and a half. The case quoted from Morgagni by Chevalier, which lasted four hours, is regarded by Dr. Christison as a case of *Simple Apoplexy*.

NARCOTICO-ACRIDS include those which possess a twofold action on the system—the one local and irritating, like that of the irritants; the other remote,

* It has been proved that a person after having taken a fatal dose of this acid, may have time to cork a bottle, or to cry out for help, and walk some steps, before it takes effect.

and consisting of an impression on the nervous system. They mostly cause narcotism, which is often attended with delirium; but one peculiar group produces neither insensibility nor delirium, but merely violent spasms.

Orfila divides this class of poisons into six groups or orders.

1. Those whose principal symptom is delirium, as atropa, datura, stramonium, &c. 2. Those whose principal symptom is tetanus, as, nux vomica, strychnia, &c. 3. Those which also excite convulsions, but at the same time cause impaired sensibility and sleep, as cocculus indicus, camphor, upas antiar. 4. Poisonous mushrooms. 5. Poisonous grain. 6. Alcohol, ether, and empyreumatic oils.

BELLADONNA.—*Symptoms.*—Dilatation and immobility of the pupils; total insensibility of the eyes to the presence of external objects, or very confused and indistinct vision; the conjunctiva turgid with purple-coloured blood; eye prominent; great dryness of the lips, tongue, palate, and throat; deglutition difficult, in some cases impossible; nausea, not followed by vomiting; sense of weakness; syncope; inability to stand upright, bending forward of the trunk of the body; continual movement of the hands and fingers, lively delirium, sometimes accompanied by the most uncontrollable laughter, sometimes with constant talking, but occasionally with aphonia. Should the person recover, the restoration to health and reason is very gradual, and there is no recollection of the preceding state.

Treatment.—Sulphate of zinc or mustard emetics, and aiding their operation by tickling the fauces; or the stomach-pump, then evacuating the bowels by brisk cathartics and enemata, and following these by doses of vinegar and other vegetable acids. According to M. Runge, lime-water is an antidote to belladonna.

STRAMONIUM.—Symptoms.—According to Orfila, the

symptoms are, intoxication, delirium, loss of sense, drowsiness, a sort of madness and fury; loss of memory, sometimes transitory and sometimes permanent; convulsions, paralysis of the limbs, cold sweats, excessive thirst and tremblings. In some cases, the skin of the face, neck, and breast was covered with brilliant stellated petechiæ. *Treatment.*—In addition to the means recommended in the treatment of poisoning by belladonna, bleeding must be had recourse to.

TOBACCO.—*Symptoms.*—Nausea, vomiting, and syncope; then stupor, stertorous breathing, general spasm, cold sweats, insensible pupil, death. *Treatment.*—This consists in the free use of stimulants.

POISON OF THE NATURAL ORDER UMBELLIFERÆ.—The hemlock (*conium maculatum*) is one of the most abundantly diffused of the umbelliferous plants. It is distinguished from all those which it resembles by its *tall, smooth, spotted* stem. Owing to the root having been mistaken for fennel, asparagus, parsley, but more particularly for parsnip, cases of poisoning by this substance are by no means very rare.*

Symptoms.—A soldier who had taken some hemlock leaves in his soup soon became insensible; his respiration was difficult, countenance bloated, pulse only thirty, and the extremities cold. Sometimes it acts purely as a soporific, like opium; at other times its effects resemble those of belladonna and stramonium; but the most common symptoms produced by it are, convulsions, furious delirium, and tumefaction of the face.

The *cicuta virosa*, or *aquatica*, possesses even more energy as a poison than the preceding.

Symptoms.—Dimness of sight, vertigo, acute headache, pain in the stomach, dryness in the throat,

* A very interesting case has been published by Dr. J. Hughes Bennett in the Edinburgh Med. and Surg. Journal, No. 164, in which it caused death by palsy of all the voluntary muscles, and then of respiration.

vomiting of greenish matter, hurried and interrupted respiration, tetanic closing of the jaws, sometimes succeeded by lethargy, with coldness of the extremities; at other times with a furious delirium, or attacks resembling epilepsy.

The hemlock dropwort (*œnanthe crocata*) seems to be the most virulent poison of the umbelliferous plants.

Symptoms.—According to Orfila, the usual symptoms are—heat in the throat and stomach, delirium, stupor, hardly ever true coma, but generally convulsions, more or less violent. In none of the fatal cases recorded, has life been prolonged beyond three hours and a half; and in several, death has taken place within an hour.

According to Godefroi, this plant is liable to be mistaken by collectors of medicinal vegetables for the officinal hemlock. Such a mistake may be attended with serious consequences, for even a single medicinal dose of an extract might cause death.

The fool's parsley (*æthusa cynapium*) is also a powerful poison. It is liable to be mistaken for common parsley, from which it may be at once distinguished by the leaves being dark and glistening on their lower surface, and by the nauseous smell they emit when rubbed.

In two children who recovered, the chief symptoms at the height of the poisoning were, complete insensibility; dilated, insensible pupil; and staring of the eyes. In one of them also, there was frequent vomiting; in the other convulsions. The treatment consisted in the administering of milk, sinapisms to the legs, and cold sponging with vinegar.

Treatment.—After the stomach has been evacuated, and the cerebral excitement reduced by bleeding and purging, the best antidote is vinegar. This treatment is applicable in each case of poisoning by the umbelliferous plants above enumerated.

POISONS OF THE NATURAL ORDER RANUNCULACEÆ.—But two of the poisons of this natural order possess narcotico-acrid properties; these are *monkshood* and *black hellebore*. Dr. Christison states that *ipecacuan*, or rather *emetine*, its active principle, may be arranged in the same class.

The monkshood, or *Aconitum napellus*, is an active poison, and a true narcotico-acrid. Every part of the plant is poisonous.

Symptoms.—In a very bad case, which, however, did not terminate fatally, there was a tingling in the jaws, extending subsequently over the body, with a sensation as if of swelling of the face, then twitching of the muscles, fixing of the eyes, trismus, failure of the pulse and breathing, but without any aberration of intellect. A case has been recorded, in which the chief symptom was maniacal delirium: it proved fatal. M. Pallas has related several examples of the irritant action of monkshood. Three out of five persons, who took a spirituous infusion of the root by mistake, died in two hours with vomiting, purging, burning in the throat, colic, and swelling of the abdomen.

All the other species of Aconitum appear to be equally poisonous with the A. napellus.

Helleborus niger (melampodium), black hellebore, Christmas rose. This is also a true narcotico-acrid poison. In a case related by *Dr. Farenhorst*, the symptoms were those of irritant poison generally, that is, burning pain in the stomach and throat, violent vomiting to the extent of sixty times in the first two hours, cramps of the limbs, and cold sweating. The most marked symptoms were soon subdued by sinapisms to the abdomen, and anodyne demulcents given internally; in four days the patient was well.

Emetine appears to be narcotico-acrid, but its irritant properties are so prominent that it might be properly arranged with the vegetable acrids.

Of poisoning by the Veratrum Album, the V. Saba-

dilla, and the Colchicum Autumnale.—These narcotico-acrids owe their properties to an alkaloid called veratria, which was formerly supposed to exist in all three; but it has lately been proved that the active principle of colchicum (*colchicia*) possesses distinctive characters of its own.

Symptoms.—In a case which proved fatal in forty-seven hours, after taking two ounces of the wine of the seeds of colchicum, the symptoms were—acute pain, coming on in an hour and a half; then retching, vomiting, tenesmus, feeble pulse, and an anxious expression of the countenance, afterwards incessant coffee-coloured vomiting, suppression of urine, excessive weakness of the limbs, and feeble respiration; and for a short period before death, profuse, dark, watery purging.

Of poisoning by Digitalis.—From the experiments of Orfila on animals with the powder, extract, and tincture of the leaves of the foxglove (*digitalis purpurea*), it seems, in moderate doses, to cause vomiting, giddiness, languor, and death in twenty-four hours, without any remarkable symptom; but in larger doses, it likewise produces tremors, convulsions, stupor, and coma.

Symptoms in Man.— When too large a dose of foxglove is taken, the effects are—great nausea, pain in the forehead, sense of dryness in the pharynx and gums, salivation, vertigo, and a slow, weak, and irregular pulse; in a few hours, there are scintillations before the eyes, subsequently dimness of vision, and a feeling of pressure on the eye-balls. Death may be produced as the result of the accumulation of digitalis in the system.

Treatment.—This consists in the administration of stimulants, such as brandy, ammonia, &c. Should convulsions come on, opiates will be found useful. The patient should be kept in the horizontal position, and on no pretext be allowed to rise suddenly from such a posture. Blisters or sinapisms to the epigastrium have been strongly recommended.

OF POISONING BY STRYCHNIA, NUX VOMICA, AND FALSE ANGUSTURA.—The second group of the narcotico-acrids includes a few vegetable poisons that have a very peculiar action. They produce violent spasms, exactly like tetanus, and cause death during a fit, according to some, by suspending the respiration. The chief peculiarity of these poisons is, that they do not impair the sensibility. The patient does not always in these cases die from tetanus; for in many instances the convulsions cease altogether, and the patient sinks in a dreadful state of exhaustion.

Several species of *strychnos* have been examined—viz., the *S. Nux Vomica*, the *S. Sancti Ignatii*, the *S. Columbrina*, the *S. Tieuté*, from which the *upas tieuté* of Java is obtained, the *S. Guinanensis*, the *S. Potatorum*, and the *S. Pseudo-Kina;* and all have been found to have the same powerful properties, and to contain *strychnia*, with the exception of the two last, which are inert.

Symptoms of Poisoning.—A young woman took between two and three drachms of powdered nux vomica in water. Her limbs soon became extended and separated, and her pulse quick and weak. Convulsions rapidly came on, during the fits of which the whole body was stiffened and straightened, and the legs pushed wide apart; no pulse or breathing could be perceived; the face and hands were livid, and the muscles of the former violently convulsed. In the intervals between the fits, she was quite sensible; her pulse was weak; she complained of sickness, with great thirst, and perspired freely. In the fourth fit, which was the most violent, the whole body was extended to the utmost; after this she seemed to fall into a state of asphyxia, relaxed her grasp, dropped her hands on her knees, and died. The fatal termination was within an hour after the poison had been taken.

The cause of death in these cases seems to be the

asphyxia, induced by the spasm, not alone of the external thoracic muscles, but also, according to Wepfer, of the diaphragm.

A great peculiarity in those cases of poisoning is, the direct action of this poison on the spinal chord, whilst the brain remains unaffected. According to Segalas, it appears also to destroy the irritability of the heart; for, in animals, he found that organ could not be stimulated after death, nor could life be preserved by artificial respiration.

Treatment.—This consists in removing the poison as rapidly as possible from the stomach. Emetics, therefore, should be immediately administered; but if the stomach-pump is at hand, it should be employed, without waiting for the action of emetics. *M. Donné* states, that he found iodine, bromine, and chlorine to be antidotes to strychnia; the iodide, bromide, and chloride of strychnia, in doses of two grains and a half, having produced no effects on a dog. Animals which had taken one grain of strychnia, or two grains of veratria, did not sustain any injury, when tincture of iodine was administered immediately afterwards; but the delay of ten minutes in the administration of the antidote rendered it useless. The alkaloid is not decomposed by the above antidotes, for by adding sulphuric acid to the iodide, chloride, or bromide, a sulphate of strychnia is obtained. The patient is generally safe when spasms do not come on within two hours after the poison has been taken.

This form of poisoning may be mistaken for *tetanus*. Tetanus, however, is never so rapidly fatal as a case of poisoning by nux vomica, and it never produces the symptoms of irritation which are present in the slower cases. The fits of tetanus are almost always slow in being formed, while nux vomica brings on fits in an hour or less.

The *S. Sancti Ignatii* is a very energetic poison. It contains about three times as much *strychnia* as

nux vomica, having from twelve to eighteen parts in the thousand.

The False Angustura Bark (*Brucia Antidysenterica*) has of late been supposed to be the produce of a species of *strychnos*. It owes its active properties to the presence of an alkaloid called *brucia*. *Strychnia* is twenty-four times as powerful as *brucia*, but the bark itself is nearly as powerful as nux vomica, eight grains having killed a dog in less than two hours.

OF THE SPURRED RYE.—Ergot or spurred rye (the *Acinula clavus*), has, in consequence of its peculiar action on the uterus, been introduced into the Materia Medica. This substance is likely to produce two distinct sets of symptoms:—the one constituting a nervous disease, which is characterized by violent spasmodic convulsions — the other being a peculiar state of the system, which ends in the formation of a dry gangrene.

Of Convulsive Ergotism.—The most acute form of this disease commences suddenly, with dimness of vision, giddiness and loss of sensibility, followed soon by cramps and convulsions of the whole body, *risus sardonicus*, yellowness of the countenance, excessive thirst, excruciating pains in the limbs and chest, and a small, quick, and imperceptible pulse. Such cases usually prove fatal in twenty-four or forty-eight hours. There is seldom any mental disturbance except in fatal cases, where epileptic convulsions and coma precede death.

Treatment.—The symptoms generally yield, if taken in time, to emetics, laxatives, and frequent small doses of opium.

Of Gangrenous Ergotism.—This disease is known in Germany by the name of the Creeping Sickness. It commences with general lassitude, weakness, and a feeling as if insects were creeping over the skin. When these symptoms have lasted some days or weeks, the extremities become cold, white, stiff, and benumbed,

so that, at length, deep incisions may be made into them without there being any sensation of pain; excruciating pains in the limbs then supervene, with fever, headache, and sometimes epistaxis; finally, the affected parts—in the first instance the fingers and arms, afterwards the toes and legs—become shrivelled, dried up, and drop off at the joints. The appetite in this case, as in the convulsive form, is voracious. Healthy granulations succeed, but the powers of life are frequently at a low ebb before this occurs.

The affections above mentioned are often epidemic in different parts of the Continent, owing to the spurred rye being mixed with the meal, and being taken as food in the form of rye bread.

Poisoning by Alcoholic Compounds.—Where an excessive quantity of spirits has been taken, so as to produce a tendency to, or even true apoplexy, the most decided steps must be taken by the practitioner. In a work of this size, it would be impossible to give the different forms which alcoholic poisoning may assume. Suffice it to say, that in all cases where a person becomes insensible from the excessive use of spirits, it is advisable to remove the poison from the system as soon as possible. With this intention, emetics, or what is preferable, if at hand, the stomach-pump, should be employed. After the poison has been evacuated, if there is much congestion, moderate bleeding should be had recourse to; if, on the other hand, there is much depression and irritability, sedatives and stimulants should be given, according as the symptoms indicate the necessity for them.

The affections produced by the habitual use of ardent spirits are, *delirium tremens*, tuberculated liver, and the disease of the kidneys described by Dr. Bright. The affections which the use of ardent spirits pre-disposes to are—indurated pancreas, indurated mesenteric glands, scirrhous pylorus, catarrh of the bladder; inflammation, suppuration, and induration of the kid-

neys; incontinence of urine, aneurisms, pulmonary apoplexy, varicose veins, mania, epilepsy, tendency to gangrene in wounds, and spontaneous combustion.

OF THE TESTS FOR THE MORE IMPORTANT POISONS.

SULPHURIC ACID. — *Concentrated sulphuric acid* may be known by its oily appearance, its corrosive power, and the heat produced by adding water to it.

When diluted, add *pure* nitric acid, and then a solution of nitrate of baryta; a heavy white precipitate, the *sulphate of baryta*, is thrown down. This precipitate at once gives a certainty of the presence of sulphuric acid, for no other acid forms with baryta a white precipitate, which is insoluble in nitric acid.

Precaution. — The nitric acid employed must not contain the slightest admixture of sulphuric acid.

NITRIC ACID. — *When concentrated*, it acts on copper, lead, or tin, evolving nitric oxide gas, which, on coming in contact with the atmosphere, is converted into nitrous acid fumes.

Morphia produces an orange colour, which soon changes to a bright yellow.

When diluted, first neutralize it with potass, then evaporate to dryness, put the residue into a tube, and heat it for a second or two with sulphuric acid. If a crystal of morphia be now added, the orange colour will be produced.

HYDROCHLORIC ACID. — *When concentrated*, its vapour if brought in contact with ammoniacal gas, produces a dense white cloud.

When diluted, on adding a solution of *nitrate of silver*, a white precipitate, *the chloride of silver*, is thrown down. This precipitate is distinguished by its remaining undecomposed at a red heat, and by its being fused into a horny substance. Again, the other white insoluble salts of silver, which are dissolved in

ammonia, are also soluble in an excess of nitric acid, with one exception, the cyanide of silver. The cyanide is distinguished, however, from the chloride by its evolving cyanogen on heat being applied to it.

OXALIC ACID.—Add Ammonia to a pure solution of this acid, a radiated crystallization will take place; the oxalate of ammonia being less soluble than oxalic acid itself. This distinguishes it from all other acids. The other tests are, Chloride of Calcium, Sulphate of Copper, and Nitrate of Silver.

Chloride of Calcium gives a white precipitate, the oxalate of lime. The easy solubility of oxalate of lime in nitric acid distinguishes it from the sulphate; while the insolubility of the oxalate in hydrochloric acid forms a distinction between it and the tartrate, citrate, carbonate, and phosphate of lime.

Sulphate of Copper causes a faint bluish-white or greenish-white precipitate, which is the oxalate of copper.

Nitrate of Silver causes a dense white precipitate, the oxalate of silver. When this is collected on a filter, dried, and heated, it first becomes brown at the edges, and then fulminates.

CAUSTIC POTASS.—When in solution, this substance has a powerful alkaline reaction on the vegetable colours, restoring reddened litmus to blue, turning syrup of violets or infusion of red cabbage to green, and rendering infusion of turmeric brown.

It is distinguished from the solutions of the *alkaline earths* by not precipitating with carbonic or sulphuric acids. It differs from *soda* in giving a yellowish precipitate with chloride of platinum, and in affording a crystalline powder on the addition of *perchloric acid*. The perchlorate of soda is very soluble, that of potass very slightly so; hence the precipitation of the latter. The acetate of soda is permanent in the atmosphere; the acetate of potass is one of the most deliquescent salts known. The tartrates and bitartrates of soda

are perfectly soluble; the bitartrate of potass but very slightly so; and when solution of tartaric acid is added to a solution of a salt of potass, it produces a white powdery precipitate of bitartrate.

ARSENIC.—The tests for arsenic are, the Ammoniacal Nitrate of Silver, the Ammoniacal Sulphate of Copper, the Hydrogen Test, Hydrosulphuric Acid, the Test of Reduction, Lime Water, Chromate of Potass, and Galvanism.

The *Ammoniacal Nitrate of Silver* causes a lemon-yellow precipitate, the arsenite of silver; nitrate of ammonia remaining in solution.

Ammoniacal Sulphate of Copper gives a grass-green precipitate (*Scheele's green*), which is an arsenite of copper, sulphate of ammonia remaining dissolved.

Marsh's Test.—Hydrogen is generated by the action of dilute sulphuric acid in *pure* zinc; and to this, the liquid suspected to contain arsenic is added. The hydrogen uniting with the arsenious acid, forms water and *arseniuretted hydrogen*. If this gas be passed through a small glass tube, and inflamed as it escapes, on a piece of cold window-glass being held in the flame, it is instantly covered with a thin coating of arsenicum. But if the flame be made to burn in the centre of a glass tube, open at both extremities, the arsenicum is oxidized as it burns, and the inner surface of the tube becomes coated with arsenious acid.

Antimony combines with hydrogen, forming a gaseous compound which is similar to arseniuretted hydrogen, in the mode of its production, in the colour of its flame when burnt, and in the deposition of a metallic crust. The two gases may be distinguished by decomposing them by heat as they pass through glass tubes; the crust deposited from the arseniuretted hydrogen being rapidly volatilized on applying the flame of a spirit-lamp to the part of the glass tube on which the incrustation has formed; while the deposit *of antimony, when* thus heated, fuses, and runs into

small globules resembling those of mercury. Further, the tube being detached from the hydrogen apparatus, and heated, if the crust be arsenicum, it volatilizes without any fumes being generated, and octahedral crystals of arsenious acid are formed in the upper part of it; on the contrary, with antimony, dense white fumes are produced, and a white amorphous powder is deposited. Again, if the tube containing arsenious acid be boiled in pure water, this substance is dissolved; on the other hand, the antimonial deposit is insoluble.

When *Hydrosulphuric Acid* is passed through a solution of arsenic, acidulated with muriatic acid, a sulphur-yellow precipitate is thrown down, which is the sesquisulphuret of arsenicum, or orpiment. This test, like those which have been enumerated, is liable to be fallacious; for selenium, cadmium, tin, and antimony, give precipitates, the colour of which resembles those of arsenic.

By taking the sulphuret thus obtained, drying it, mixing it with black flux, and heating the mixture to a red heat in a glass tube, a metallic crust of an iron-grey colour externally, and crystalline appearance internally, is deposited on the cool part of the tube. This distinguishes the sulphuret of arsenicum from most other substances.

Lime Water causes a white precipitate with arsenious acid. This test is a very ineligible one.

Chromate of Potass causes the slow deposition of a green precipitate, the sesquioxide of chromium; the chromic acid being partially deoxidated by the arsenious acid.

Reinsch's Test.—Acidulate some of the suspected fluid with hydrochloric acid, and introduce a small plate of bright copper; in a short time, arsenicum is deposited in an iron-grey crust.

During the sublimation of arsenicum, a garlic odour is produced. Zinc is the only metal which gives a

somewhat similar odour when thrown in powder on burning charcoal.

BICHLORIDE OF MERCURY.—The best tests for Bichloride of Mercury, in solution, are—Hydrosulphuric Acid, Iodide of Potassium, Protochloride of Tin, Galvanism, Caustic Potass, and the Nitrate of Silver. Numerous other tests have been proposed and employed, but those here enumerated will be found to give satisfactory evidence of the nature of the poison.

Hydrosulphuric-acid Gas causes a dark brownish-black precipitate, the bisulphuret of mercury. When the solution contains much bichloride, the precipitate is at first white or yellow, and gradually blackens; this is said to distinguish the mercurial precipitate from that of all other metals. This test will detect the bichloride where its proportion is only a 35,000th part of the solution.

This test does not give satisfactory evidence of the presence of the bichloride of mercury, for hydrosulphuric acid produces dark precipitates in the solutions of copper, lead, bismuth, and silver.

Iodide of Potassium gives a pale scarlet precipitate, which rapidly deepens in tint; this is the biniodide of mercury. This test acts where the bichloride forms only a 7000th of the solution.

Protochloride of Tin causes a white precipitate at first, but when more of the test is added, the deposit becomes of a greyish-black colour. In this case, the protochloride of tin gradually abstracts the chlorine from the bichloride, the white precipitate being protochloride of mercury, which, on more of the test being added, yields its chlorine, and metallic mercury remains. The bichloride of tin which is formed remains in solution. This test acts on solutions containing only an 80,000th of the bichloride.

The *Galvanic test* consists in placing a drop of the suspected liquid on polished gold, and touching the moistened surface with a piece of iron wire or the

point of a penknife, when the part touched becomes white, owing to the formation of an amalgam of gold.

When the solution is very weak, the method proposed by M. Devergie is the best. A thin plate of gold and another of tin, a few lines broad and two or three inches long, being closely applied to one another by silk threads at the ends, and then twisted spirally, form a galvanic pile, which is left for twenty-four or thirty-six hours in the solution previously acidulated with hydrochloric acid; at the expiration of the time mentioned, the gold is found whitened, and mercury may be obtained in globules by heating the gold in a tube. By this process, distinct indications of the presence of corrosive sublimate are given, when it forms but an 80,000th of the solution.

Caustic Potass throws down a yellowish precipitate, the peroxide of mercury; chloride of potassium remaining in solution. Sublime this oxide in a glass tube, by the heat of a spirit-lamp, and globules of mercury are procured. *Lime Water* also throws down the peroxide of mercury, from which the metal may be obtained by a similar process.

Nitrate of Silver gives a white precipitate, the chloride of silver, which darkens by exposure to the light. This is a test for the chlorine, and is merely used to determine how the mercury is retained in solution.

COPPER.—The tests for copper in solution are, Ammonia, Hydrosulphuric Acid, Ferrocyanide of Potassium, and Metallic Iron.

Ammonia gives a pale azure-coloured precipitate, which is redissolved by an excess of the test, forming a deep violet-blue solution.

Hydrosulphuric Acid Gas gives a brownish-black precipitate, the sulphuret of copper.

Ferrocyanide of Potassium gives a reddish-brown precipitate, the ferrocyanide of copper.

A polished plate or rod of *metallic iron*, held in a

solution of sulphate of copper, soon acquires a coating of copper; the solution at the same time changes colour from a blue to a greenish-yellow. In this case, a sulphate of iron displaces that of the copper in the solution.

ANTIMONY.—The tests for Tartarized Antimony in solution are, Hydrosulphuric Acid, Caustic Potass, Lime Water, Infusion of Gall-nuts, and Carbonate of Potass.

Hydrosulphuric Acid Gas causes an orange-red colour, which, when the excess of acid is expelled, deposits a precipitate of the same tint. The colour of this precipitate is sufficient to distinguish it from all other sulphurets.

Caustic Potass throws down a white precipitate, the oxide of antimony. The oxide is redissolved by an excess of the reagent.

Lime Water gives a white precipitate, a mixed tartrate of lime and oxide of antimony.

Infusion of Gall-nuts throws down a dirty yellowish-white precipitate, which consists of tannic acid and oxide of antimony.

Carbonate of Potass is said to separate the oxide more perfectly than the caustic alkali.

Should there remain any doubts as to the nature of the poison, the hydrogen test, mentioned when treating of the tests for arsenic, may be employed.

SILVER.—Hydrochloric Acid and Ammonia form the best tests for nitrate of silver in solution.

Hydrochloric Acid causes a dense white precipitate, which passes into a dark brown under exposure to light.

Ammonia gives a dark-brown precipitate, which is redissolved in an excess of the alkali; when the precipitate is taken up in this way, and arsenious acid is added, a yellow deposit is thrown down, which passes into a brown, if left exposed to light.

ZINC.—The tests for the salts of zinc are, the Caustic

Alkalies, the Alkaline Carbonates, Hydrosulphate of Ammonia, and Hydrosulphuric Acid.

The *Caustic Alkalies* give a white precipitate, the hydrated oxide of zinc, which is soluble in an excess of the precipitant.

The *Alkaline Carbonates*, carbonate of ammonia being the best, cause a white deposit, the carbonate of zinc.

Hydrosulphate of Ammonia gives a white precipitate, the hydrated sulphuret of zinc.

Hydrosulphuric Acid gives a similar precipitate to the foregoing, if the solution be quite neutral; but it has no effect if an excess of any strong acid be present.

LEAD.—The best tests for acetate of lead in a state of solution are, Hydrosulphuric Acid, Chromate of Potass, Iodide of Potassium, and Metallic Zinc.

Hydrosulphuric Acid gives a black precipitate, the sulphuret of lead.

Chromate of Potass causes a gamboge-yellow precipitate, the chromate of lead.

Iodide of Potassium gives a yellow deposit, the iodide of lead.

Metallic Zinc, suspended in a solution of a salt of lead, causes a crystalline deposition of the latter metal on its surface, giving rise to the appearance called *arbor Saturni*.

CANTHARIDES. — The powder of cantharides, no matter how fine, presents small points of a resplendent green colour and metallic brilliancy, when examined in a bright light. Again, by treating the suspected powder with ether, filtering and evaporating the solution, and applying the residue to the arm, quick vesication ensues.

OPIUM.—*Of the tests for Meconic Acid.*—1. When heated in a tube, it is partly decomposed and partly sublimed, and the sublimate consists of filamentous radiated crystals.

2. When dissolved in a very large quantity of water, the solution acquires an intense cherry-red colour, on

adding *a persalt of iron.* Sulpho-cyanic acid, which is a very rare substance, is similarly affected by the persalts of iron.

3. Its solution gives a pale-green precipitate with *the sulphate of copper;* if the precipitate is not too abundant, it is dissolved by boiling, and reappears on cooling.

4. *Chloride of Gold* causes a dark inky precipitate with meconic acid.

Of the tests for Morphia—1. Nitric acid strikes an orange-red colour, which, if there be an excess of the acid present, quickly passes to a yellow. The change of colour produced by nitric acid is said to be owing to the morphia containing some resinoid matter; but the purest crystals that can be obtained are acted upon by this reagent.

Nitric acid produces a similar effect on brucia and strychnia. To distinguish these, Dr. Vassal proposes to use the *chloride of tin.* If the liquid contain morphia, it will become yellow; if brucia, a violet colour; and if strychnia, it will become colourless.

When suspended in water in the form of a fine powder, and treated with a drop or two of solution of permuriate of iron, it is dissolved, and forms a deep-greenish-blue solution—the tint being more purely blue the stronger the solution is, and the purer the morphia.

Pelletier asserts that this blue colour is owing to the morphia attracting a portion of the oxygen of the peroxide of iron, and then uniting with a part of the protoxide, forming a morphite of iron.

3. *Solution of Iodic Acid* is turned brown either by morphia or its salts,—the morphia deoxidizing the acid, and setting its iodine free. It is the only alkaloid which produces this effect, and the test is so delicate that it affects a solution containing a seven-thousandth of morphia.

HYDROCYANIC ACID.—The tests for Hydrocyanic Acids are its odour, the Salts of Copper, the Proto-

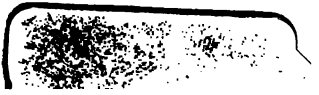
According to Orfila, the *peculiar odour* of this acid is perceptible when no chemical reagent can detect it.

Sulphate of Copper gives with hydrocyanic acid, when rendered alkaline by potass, a greenish precipitate, which becomes nearly white, on the addition of a little hydrochloric acid. This precipitate is a cyanide of copper; and the use of the hydrochloric acid is, to redissolve some of the oxide of copper thrown down by the potass.

Protosalts of Iron give with hydrocyanic acid, previously rendered alkaline with a little potass, a greyish-green precipitate, which, on the addition of a little sulphuric acid, and exposure to the air, becomes of a deep Prussian-blue colour.*

Nitrate of Silver yields a white precipitate, the cyanide of silver. This is distinguished from the other white salts of silver by being insoluble in cold nitric acid, but soluble in it when boiling. On heating this precipitate, cyanogen gas is given off, which may be known by its rose-coloured flame.

STRYCHNIA.—Strychnia is known from other alkaloids more by negative characters than by any characteristic tests. As it is usually found, it is turned orange-red by nitric acid, which tint is changed to a violet-blue by the gradual addition of hydrosulphate of ammonia. Pure strychnia is not coloured by nitric acid; the yellow colour is generally owing to the presence of resinoid matter, or of brucia, which is also contained in the *nux vomica*.

* When the acid is added to protoxide of iron, a protocyanide is formed; on adding an acid, and exposure to the air, oxygen is absorbed, part of the protocyanide is converted into a sesquicyanide, and the protoxide and sesquicyanide combined, form Prussian blue. For fuller information respecting all points of Toxicology, the student is referred to Dr. Guy's excellent Principles of Forensic Medicine.

THE END.